

Influential factors in the application of flute vibrato

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Thesis presented in partial fulfilment of the requirements for the degree

MMus
(Music Performance)

Faculty of Arts
Stellenbosch University



April 2008

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously, in its entirety or in part, submitted it at any university for a degree.

Minette Maré
1 November 2007

Foreword

I would like to thank the following people, for without their help, guidance and support this thesis would not have been possible.

I would like to thank my parents for their unconditional love, and financial and emotional support. Thank you for raising and guiding me to being the person I am today. Through your example, I have learnt that with hard work and dedication any obstacles can be overcome. You have helped me realise the importance of objectivity and of having a constantly inquiring mind.

I would also like to thank Prof. Winfried Lüdemann for his patience with and commitment to this project. Thank you for helping me to formulate my thoughts in a more congruent and logical way. It is through your invaluable guidance that I have been able to finish a thesis of which I am proud.

Thank you to Wilken Calitz for his assistance in the technical intricacies of recording, analysing and incorporating this data into a medium that made it functional for the purpose of this study.

Lastly, I would like to thank my mentor and teacher, Dr Corvin Matei. Thank you for introducing me to music and teaching me that self-expression is not the only important element in musical performance. Thank you for guiding me in my analysis of the intricacies of flute playing and for helping me discover how much more important it is to listen than it is to just play your instrument. It is through your teachings that I have become the musician I am today.

Abstract

This thesis provides an overview of different aspects of the application of vibrato on the flute. Although it is a compilation of different viewpoints, it does not offer a conclusion as regards the ‘correct’ application of vibrato, due to the subjective nature of this phenomenon. The intention is that the reader will be able to reach his or her own conclusions and form new opinions regarding this subject.

The focus is largely on the comparison of the production of vibrato on the flute with its production on other instruments. The aim is to examine the different choices involved in the production of vibrato when the flute is part of an ensemble and when it is a solo instrument. By learning more about other instruments’ timbres and production of vibrato, it enables flautists to adapt to different timbres in order to form sonorous ensembles.

The physiological and scientific aspects of vibrato are also explored with the view to equip flautists with this knowledge. Thus, flautists will be able to listen to and analyse from a more critical and informed perspective how they themselves use vibrato and how other flautists use it.

The main goal of this thesis is to provide enough information, opinions, studies and statistics to enable a flautist to make an informed decision concerning their choice and application of vibrato.

Opsomming

Dié tesis handel oor die toepassing en gebruik van vibrato in moderne fluitspel. Vibrato is 'n uiters subjektiewe onderwerp, dus het die navorser dit goed gedink om soveel moontlik toepaslike inligting aan die leser te gee sodat die leser onafhanklike gevolgtrekkings en opinies kan vorm.

Daar word nie net na die fluit as solo-instrument verwys nie, maar ook na die fluit se rol as ensemble-instrument. Die grootste fokus lê in die vergelyking van toonproduksie op die fluit teenoor toonproduksie op ander instrumente. Deur meer inligting hieroor aan die leser te verskaf, beoog die navorser om fluitspelers te help om makliker by ander *timbres* en instrumente te kan aanpas.

Die fisika en fisiologie van die produksie van vibrato word ook aangeraak. Hierdeur poog die navorser om fluitspelers te help om uit 'n meer objektiewe oogpunt na vibrato te kyk. Die doel van hierdie kennis is om fluitspelers te help in die analise van nie net hul eie klank nie, maar ook dié van hul ensembles.

Die einddoel van hierdie tesis is om fluitspelers in staat te stel om genoeg kennis te hê om 'n ingeligte besluit te kan neem ten opsigte van die toepassing van vibrato, asook die tipe vibrato wat hulle gebruik.

Index

Opsomming / Abstract	4
Introduction	8
Chapter 1	
An historical overview of vibrato and views regarding its application	13
Chapter 2	
Physiological and physical aspects of vibrato	
2.1 The physiology of vibrato	22
2.2 The physiology of the throat structures involved in the production of vibrato	26
2.2.1 An empirical study of the physiological aspects of throat vibrato	27
2.2.2 The throat structures	27
2.2.3 Brown's cinefluorographic tests	
2.2.3.1 Procedure	32
2.2.3.2 Observations	33
2.3 The physiology of the abdominal muscles and their use in vibrato production	
2.3.1 Introduction	34
2.3.2 The three types of breathing	36
2.3.3 Posture	37
2.3.4 The three stages of breathing	40
2.3.5 The nose	45
2.3.6 The epigastrium	46
2.3.7 The diaphragm	47
2.3.8 The discontinuing of thoracic breathing	48
2.3.9 Faults relating to breathing	49
2.3.10 Subglottic pressure	51
2.3.11 Summary	53
2.4 Physical aspects of Vibrato	54
2.4.1 The three types of vibrato	55
2.4.2 Current developments	57
2.4.3 Analysis of physical characteristics of flute vibrato	58

Chapter 3

Vibrato and expression

3.1	A discussion of current vibrato practice with particular reference to different schools of flute playing and influential teachers	91
3.2	Vibrato as an expressive device	100

Chapter 4

A comparison between the applications of vibrato on the flute with that on other instruments

4.1	The production of vibrato	108
4.1.1	Reed instruments	109
4.1.2	String instruments	111
4.1.3	The voice	116
4.2	Original study	
4.2.1	Motivation	119
4.2.2	The musicians	119
4.2.3	Method	124
4.2.4	Findings	125
4.3	Conclusion	127

Chapter 5

Current teaching methodology of vibrato

5.1	Introduction	135
5.2	Teaching vibrato	137
5.2.1	The heart of the tone: Support	138
5.2.2	Exercises to correct faulty breathing techniques	139
5.2.3	The heart of the tone: Shape and resonance	141
5.3	Problematic vibratos	142
5.3.1	The wobble	143
5.3.2	The slow, heavy vibrato and the nanny goat quiver	144
5.3.3	The straight tone	145
5.4	To teach or not to teach	146

Conclusion	148
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Bibliography	150
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List of figures	155
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Introduction

During her career as a flautist, the author has encountered many situations where it was necessary to make decisions about the employment of vibrato, but where it was difficult to decide which kind of vibrato was appropriate. Most frequently, such situations arose in the context of playing in one or other ensemble. Many considerations come into play when a flautist has to take such decisions. First and foremost is the style of the piece that is being performed. An example of this is the varying opinions on the so-called historically informed performance of Baroque music. Many musicians prefer that a Baroque piece should be played with little or no vibrato; the opposing view however believes that we are playing these pieces on completely different instruments and should therefore have more freedom in the type of vibrato applied. The instrument is now made from a metal alloy, silver, and in rare cases of gold, whereas baroque flautists played on a wooden instrument with one or two keys. With the timbre itself being so different, should it not follow that our type of vibrato should also differ? It goes without saying that stylistic considerations are not limited to Baroque music, but apply equally to all other styles of music.

The second consideration is the degree of artistic freedom a flautist should be allowed when applying vibrato as a means of expression (e.g. shaping of a phrase, stressing important notes, and projecting a melody). It seems obvious to assume that there should be guidelines according to which the flautist can choose which type of vibrato to use. However, a comprehensive literature survey showed that such guidelines have never been discussed in printed form.

Lastly, it could be argued that the nature of the ensemble (e.g. combination of instruments) should guide the flautist in his or her choice and application of vibrato. For example, when flautists play with a string quartet, they should adapt their vibrato to that of the string players, not only as regards frequency and extent, but also as regards the use of hand, wrist or arm vibrato. A flautist playing with a wind quintet should realise that the vibrato on an oboe, clarinet or horn will differ greatly from that of string players

(clarinets seldom play with vibrato, while the extent of the vibrato for horn and oboe is a lot smaller), and he or she should therefore adjust their vibrato accordingly to form a sonorous ensemble sound. Since very little has been written on this subject, the author came to this conclusion by playing in ensembles and listening to the opinions of fellow musicians who did not agree with her application/choice of vibrato.¹

The author was consequently motivated to undertake an in-depth literature study on everything that had been written on the application and use of vibrato by flautists. Much to her surprise, she found that, in the literature on the history of the development of the flute and flute technique, hardly anything had been written on the use of vibrato other than on how to develop it.² This not only represents a basic lack in flute pedagogy, but also shows up a lack of reflection about the matter in respect of performance practice in particular and amongst performers in general.

The most helpful book regarding the application of vibrato in the Baroque, Classical and Romantic eras is by far Nancy Toff's *The Flute Book* (1996:108). Although this book deals mainly with the modern Böhm flute, it also contains an extensive chapter on the history of performance techniques. The chapter quotes from Agricola's *Musica instrumentalis deutsch* (1528) and Johan Joachim Quantz's *Versuch* (1752), explaining how the vibrato was produced by a finger *flattement* in those times.

It also shows very clearly how, when J. Harrington Young wrote in his 1892 method that vibrato (referring to "breath"³ vibrato) can be used in slow movements where pathos is required, the great split occurred which resulted in the formation of two schools of thought (As cited in Toff 1996:10). These schools consisted of those who believed that the flute is allowed to imitate the string instruments' vibrato and those who believed that finger *flattement* was the only accepted form of vibrato and should be used simply as ornamentation.

¹ The three different vibratos of the flute are the lip, throat and diaphragm vibrato.

² This refers to the teaching methodology of vibrato.

³ It seems that this was the first occasion where the term vibrato refers to something produced by breathing, whether helped by the diaphragm, lip or throat.

One thing is certain: the taste for vibrato has definitely changed. Fritz Kreisler was turned down by the Royal Opera House orchestra for his “restaurant vibrato”, yet later, his “golden tone” became the ideal to be copied by all other violinists (Toff 1996:111). The same can be said for vibrato used by flautists.

As regards the use of vibrato as a means of expression, the author found only a few articles in *Flute Talk* magazine, where it was briefly mentioned in interviews with flautists such as James Galway, Geoffrey Gilbert and Britton Johnson.

However, this does not mean that modern flautists do not question the use of vibrato. The author in fact found a large number of flute forum pages on the Internet where flautists discuss vibrato and the problems they experience with it. The problem with a concept such as “expression” is that it is an immensely subjective concept. How are we to know what the terms a “generous” or “appropriate” amount of vibrato refers to? Dean Stallard (2007) for example writes, “when Liz asked me about doing an article on vibrato I laughed and replied, ‘whoa, that’s a can of worms’ and wondered what I’d done to upset her!”

However, as with most of the discussions on this topic, the article simply suggests listening to other musicians to try and develop an ear for what is seen as a “tasteful” amount of vibrato, and then continues on the subject of how to teach vibrato when students do not naturally develop this themselves. The only article that did venture to have an in-depth discussion on this matter was that of Larry Krantz (2005). Most of his published articles are available on his home page, where he carefully notated a series of master classes given by Peter Lloyd at St. Olaf’s College, London, in June 1990.

Of all the research the author has done on various publications by modern flautists (i.e. flautists using vibrato as it is known today), it is only Edwin Putnik (1970) who refers to the flute’s need to adapt in an ensemble context. A few other documents written on the intonation of the wind section of an orchestra (Matei, 2001) or the intonation of the wind

ensemble (Chandler, 1981) contain a paragraph or chapter on the influence that vibrato has on pitch, but these do not provide sufficient information to answer the researcher's queries.

Aims and Objectives

The above discussion reveals a lack of literature that deals with flute vibrato in more than a superficial manner. This could be seen as a coincidence, or it could be a true reflection of the present state of vibrato application in practice. The author is of the opinion that the second scenario holds true. This thesis aims to contribute to rectifying this situation by embarking on a comprehensive discussion of the topic. Apart from an historical overview, vibrato will be analysed in terms of its constituent parts and in terms of its stylistic application. The results of this investigation will form the basis for recommendation for flautists and teachers alike.

In accordance with these objectives, the research underlying the present thesis was divided into four sections. It was deemed appropriate that the thesis itself reflect this four-fold division. The first section deals with the question, *Where does vibrato come from?* This section consists of a compilation of opinions, ranging from the Baroque era up until today, as well as a discussion on the different schools of flute playing.

The second section deals with the simple question, *What is vibrato?* The physiological elements that come into play when vibrato is produced (whether it is lip, throat or diaphragm vibrato) as well as the physical aspects of vibrato (analysed in wave format) will be discussed in this section.

The third part of the research project consists of an in-depth look at the application of vibrato for solo flute performance as well as ensemble playing. A comparative study in vibrato production on different instruments could guide the flautist in an ensemble context, whilst an analytical discussion of the concept of "expression" and the resultant artistic freedom could guide the flautist in a solo performance context.

The final part of the research project refers to the two different schools of thought on the teaching methodology of vibrato. The author aims to portray both schools equally to enable the reader to draw an informed conclusion. Furthermore, the author explains how common vibrato problems can be corrected through various exercises.

CHAPTER 1

An historical overview of vibrato and views regarding its application

Throughout the history of the instrument, the phenomenon of vibrato has represented one of the least understood aspects of flute playing. In this regard, it should be noted that the use of vibrato as we know it today – a more or less continuous pulsation or shimmer in the tone – only developed in the late nineteenth century in Paris. Even so, the great flautist Marcel Moyse, father of the French flute school, stated: “Vibrato? It is worse than cholera and [it] ... is used so excessively that all music is distorted by its constant waver” (cited in Lehmann-Waffenschmidt 2002:2).

The question therefore arises as to how vibrato has become such a point of contention, despite being common practice in modern flute playing. Most of the blame for this state of affairs can be placed on the misuse of vibrato. The problem arose when some flautists started using vibrato to conceal inferior intonation or insipid timbres, or when the vibrato of other flautists was imitated without a proper understanding thereof. Some critics even went as far as labelling vibrato as a *cache-misère*, literally *misery hider*, i.e. something to hide behind when faced with problems of intonation and tone quality (cited in Toff 1996:109).

It is important to understand that the term vibrato was not used until the nineteenth century. The first reference to any sort of pulsating airstream is made in Agricola’s *Musica instrumentalis deutsch* (1528), where he states that the “trembling breath” should be used as a special grace. Praetorius (1619) also refers to this “tremolo that can intoxicate the soul” that is created by diaphragm action, and Mersenne (1636) refers to the organ tremolo (of approximately four pulsations per second) as a model for flautists to imitate (cited in Toff 1996:109).

From the eighteenth century and onwards, however, flautists started using a type of finger vibrato or *flattement*.⁴ In his authoritative treatise of 1707, Hotteterre (1968:34) explains in great detail how to produce a finger vibrato. This, he states, is achieved by wavering the fingers up and down at a distance over the holes from the last hole covered for any particular note, creating a diminishing of volume and lowering of pitch within a single note. Delusse (about 1791) again mentions the possibility of creating a tremolo using the breath, used in imitation of the organ tremulant, to express “solemnity” and “terror” (cited in Toff 1996:109).

It appears, however, that there was already disagreement on the subject of vibrato amongst flautists at this stage of the flute’s development. These differences of opinion not only concerned the importance of vibrato – Quantz (Quantz 1976:23), for example, mentions it only briefly – but also the way in which it is produced. The so-called “breath vibrato”, which is possibly where vibrato as it is known today originated, was very badly received, but still practiced by some flautists. Tromlitz⁵ (cited in Hartig 1981:213-214) mentions that vibrato “is not done with the breath on the flute: this does not have a good effect, but makes a wailing sound.”

As keys were added to woodwind instruments, however, the finger vibrato eventually fell into disuse and was not a normal part of flute playing during the nineteenth and twentieth centuries.

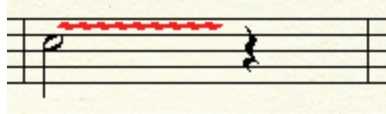
In the nineteenth century, a number of treatises were published, most of them explaining finger vibrato, but it appears that “breath vibrato” was gradually replacing the former as the accepted form of expression. British flautist and publisher W.N. James (1826) writes,

⁴ Quantz refers to *flattement* as *messa di voce* in his *Versuch* (1752). Tromlitz (1791) refers to this technique as *Bebung* (cited in Toff 1996:109).

⁵ Tromlitz’s treatise, first published in 1791, allows us an insight into performance practice of the last part of the eighteenth century. Tromlitz, who assumed that his reader was familiar with the Quantz essay, felt that as good teachers were in short supply, a further treatise on the flute was needed. The treatise includes information about the rudiments of music, basic technique, ornamentation, breathing, intonation, key signatures, and articulation.

Vibration on the flute ... when introduced judiciously and sparingly ... [has] an exceeding[ly] fine effect ... (But) great caution should be taken that the beginning of the note shall be neither flatter nor sharper than the middle or ending of it (cited in Toff 1996:110).⁶

Charles Nicholson, James's contemporary, refers to "vibration" as an ornament and notates this as a wavy line above the note.



He describes this embellishment as something that should imitate the beats or pulsations of a bell or glass, starting slowly, increasing in speed and to be produced by

[the] breath, by a tremulous motion of the Flute, and by the shake. If by the breath, the moment the note is forced, subdue the tone, and on each succeeding pulsation, let the tone be less vigorous. When the Vibration becomes too rapid to continue the effect with the breath, a tremulous motion must be given to the Flute with the right hand, the lips being perfectly relaxed, and tone subdued to a mere whisper (cited in Toff 1996:110).

Victor Coche (1838) refers to a type of flute vibration practically identical to that of the voice, which he called *le chevron*, notated as a type of accent.



Toff states that this vibration "consisted of a forceful attack, followed by a less forceful sound ... a half note with a chevron would be played as a series of tied eighth notes" (1996:110).

⁶ James therefore referred to a fluctuation in intensity (dynamics) rather than that of pitch.

Richard Carte (mid-nineteenth century) describes the tremolo as

a grace that consists of wavering of a note. It is produced on the Flute either by giving a tremendous impulse to the breath, or by tremulously holding the instrument. It is used in passages of *pathos*, and is indicated by the word *tremolo*, or is introduced at the fancy of the Performer (cited in Toff 1996:110).

For the first time, a clear difference is noted between the word *tremolo* and the word *vibration*. A vibration is seen as something more “delicate”, which should occur only on longer notes and should vary in tempo, determined by the note’s dynamic marking. If the note is to be played softly, the vibration should be fast, compared to a loud note, which would result in a slower vibration.

According to Toff, the first theorist to recommend the use of breath vibrato specifically was J. Harrington Young (1892), with the following clear indication of how it should be used:

... it should be used in very pathetic movements – such as Adagios and Andantes where great pathos is desired; but, if too frequently used, this becomes vulgarized and unpleasant. Some players produce the effect by a tremulous motion of breath, which is inadvisable, as by its frequent use it endangers the production of a steady tone, which is far more desirable than any artificial effect (cited in Toff 1996:110).

It is here that the problem begins. The flautist is expected to use vibrato at his or her own discretion, and this naturally differs from one flautist to the next. The lip/jaw vibrato is first mentioned by Fürstenau (cited in Toff 1996:110) in 1844 and the throat vibrato is mentioned in detail in Maximilian’s treatise in 1910 (quoted in Toff 1996:113)⁷: “This type of ‘bleating’ or ‘quavering’ throat vibrato, called *chevrotement* by the French, was disavowed by the German flute school.”

⁷ These tutors are as yet not available in English translation, and even some facsimile editions are now out of print.

Although diaphragm vibrato has since been advocated by most twentieth-century wind players and has become standard practice, there are still musicians – and not only flautists – who disagree with this type of vibrato. In an article published in 1951, the violinist Henry Welsh made the following statement:

...as for woodwinds, I fail to see any aesthetical or technical reason why they should trespass on the noble and intimate qualities which belong so inseparably and essentially to the strings. A plea that vibrato-playing enhances the quality of tone cannot therefore be upheld. Wind instruments should be played with a tone that is as steady as a rock and as pure as crystal. (cited in Toff 1996:112)

One might well ask whether his opinion was formed by an exposure to the misuse of vibrato and if this would indeed still be his opinion today. Even the flautist Georges Barrère, who is regarded as one of the wind players that brought woodwind vibrato to the United States, was quoted by one of his students, Bernard Goldberg, as saying: “For three hundred years flautists tried to play in tune. Then they gave up and invented vibrato” (cited in Toff 1996:113).

The first musicians who started using the vibrato as we know it today were part of the French school of flute playing. According to Toff, the flautists Paul Taffanel and oboist Fernand Gillet were two of the main instigators. This may seem surprising in view of the statement by Taffanel in the Taffanel-Gaubert method:

There should be no vibrato of any form of quaver, an artifice used by inferior instrumentalists and musicians. It is with the tone that the player conveys the music to the listener. Vibrato distorts the natural character of the instrument and spoils the interpretation, fatiguing quickly the sensitive ear. It is a serious error and show unpardonable lack of taste to use these vulgar methods to interpret the great composers. The rules of interpretation are strict: It is only by purity of line, by charm, deep feeling and heartfelt sincerity that the greatest heights of style may be reached. All artists should work towards this goal (cited in Toff 1996:111).

Taffanel then continued to co-write an article Louis Fleury published in the *Encyclopédie de la Musique et Dictionnaire du Conservatoire* (1926) on the flute (*La Flûte*), in which he argues,

The search for timbre, the utilization towards this end of light, almost imperceptible vibrato ... all this derives more from an intelligent empiricism (practical experience) than from precise rules. It is very difficult, besides, to define with certainty what to call a beautiful sound. It is easier to describe faults than to avoid them.

Toff clarifies these seemingly opposing views by writing in a chapter dealing with vibrato in her *The Flute Book* (1996):

Adolph Hennebains, Taffanel's student and successor as flute professor at the Paris Conservatoire, provides the key to understanding Taffanel's apparent inconsistency. 'When he spoke to us of notes with vibrato or expression, he told us with a mysterious air that these notes, forte or piano, seemed to come from himself. One had the impression that they came directly from the heart or the soul.' In other words, it was intuitive, 'natural', not mechanical or premeditated. Similarly, Marcel Moyse recalls, in Philippe Gaubert's classes there was no talk of vibrato per se, but Gaubert spent many hours on musical expression, the idea being 'speaking with music', Yet Gaubert's recording of Bach's fifth Brandenburg Concerto has a shallow fairly rapid vibrato (Toff 1996:111).

We now realise that the term *expression* contains a number of different components, including vibrato. French flautists often speak of playing expressively, but rarely mention vibrato, except in a negative context. They tend to consider expression, and thus vibrato, as an integral component of tone production. Marcel Moyse was quoted as saying he never used vibrato, and yet it is clearly present on his recordings. Recordings as early as 1905 (Taffanel) reveal that French flautists did indeed use vibrato, but they would often only say that they played *expressively*.

Peter Lloyd and Geoffrey Gilbert both use the term *expression* from having studied in France. According to Gilbert (cited in Lord 2005), the term *expression* more accurately describes the total content of the sound, including volume and tone colour, in which one's vibrato becomes part of the sound, not something one does to a sound.

Peter Lloyd (in Lord 2005⁸) made the following statement in response to the above utterance:

Having understood what that (previous quote) means, it means that when you use vibrato, it is a positive, thought-out reasoning. You use it because you think it. If you are shimmering to keep colour alive, then it's very, very light, so light that you hardly notice it. And I don't think that that is the same thing (as vibrato) at all. Vibrato is something that you consciously add.⁹

The English and the Germans were the ones who resisted using vibrato the longest (Toff 1996:112). Lloyd (cited in Lord 2005) believes that this could have something to do with the long-standing animosity between these European countries:

I don't know why Germany didn't. They left it [vibrato] out for a long time ... I think they were aware of it ... There were big wars between France and Germany. Maybe there was such an aversion ... to anything French in Germany that they would not accept [it].

It seems that vibrato followed the silver flute. Countries slow in adopting vibrato also tended to be slow in adopting the silver flute, keeping the wooden flutes instead.

The fact that the vibrato as we know started to become standard practice in the same years (around 1930) that Moyse started playing in the Opera is no coincidence. He was obviously exposed to singers, and listening to their timbres and vibrato, tried imitating them to copy that quality.

Woodwind vibrato was introduced to the United States during the early twentieth century due to numerous French musicians immigrating. Amongst the foremost of these being George Barrère, George Laurent, Gillet and oboist Marcel Tabuteau (long-time principal of the Philadelphia Orchestra).

⁸ When an internet sources is quoted within this paper, no page numbers are cited. (in accordance with Harvard referencing method)

⁹ The statements are direct quotes from Larry's notes on the master classes given by Peter Lloyd.

This vibrato, however, was still not the sound ideal that we are used to today. Toff explains that “[t]he vibrato as first imported to the United States was, true to its roots, both rapid and naturally produced. Barrère’s was reportedly very rapid indeed” (1996:112).

Barrère (1944:192) states in an article that, “[i]t being settled that expression in music *must* be a love message, music has to be performed with a quiver in the tone, much as the histrionic lover’s lines must be spoken with a *tremolo* in the voice.”

Only to, later in the article, contradict himself by saying,

For the first fifty years I had been tooting my instrument, my daily care was to avoid the vibrato ... vibrato was produced by taking a pure tone and moving it above and below correct pitch at a certain rate or speed, thus indulging in playing more or less out of tune! ... To declare that expression might sometimes be achieved just by the absence of vibrato, would, in most quartets, only earn an incredulous frown. Isn’t it still possible to express Beauty by pure lines, such as we find in ancient Greek marbles? (1944:197)

The sound ideal started to change towards the late twentieth century, however. According to Toff (1996:107),

Barrère’s student John Wummer (long time solo flautist of the New York Philharmonic), was the last of the fast-vibrato school, though even Wummer’s vibrato slowed down in later years. William Kincaid was the pioneer in developing a slower vibrato. Just as he sought a darker, fuller sound than the traditional birdlike sound of his French predecessors, he sought a slower, more intense vibrato.

In an interview, Paige Brooke (flautist for New York Philharmonic) states, “Kincaid was the one who brought it closer to the way string instruments use it – smoother and more controlled, variable speed vibrato depending on what intensity one wants, and making it an integral part of flute playing” (Lawrence 1977:3).

It is important to understand that these musicians were trying to experiment with tone, vibrato and expression, and left the field wide open for later generations of flautists to decide which school of flute playing to follow. Although we have the records of musicians from the recent past, for the preceding centuries there is not really a *right* or *wrong* way of applying vibrato. The instruments of those times differed, which obviously had an effect on their tone and made the way of playing them different. The only guideline the modern flautist has is to play within *good taste*. Having such a subjective guideline, it is our duty to be fully aware of the possibilities of the vibrato that we are using today.¹⁰

¹⁰ This will be discussed in more detail in Chapter 3.

CHAPTER 2

2.1 The physiology of vibrato

The lack of literature on flute vibrato also extends to the physiological (and physical) aspects of the technique. In order to gain a better understanding of the physiology of vibrato production it is necessary to learn from research done in related areas. It appears that amongst all “wind instruments” research into the physiology of vibrato has progressed furthest in the area of singing. Even though playing the flute and singing may seem to be quite far apart at first glance, they are related in an important aspect: in both cases, vibrato is a function of breath control.

Although the source of actual phonation differs from the flute (in singers phonation takes place in the vocal folds compared to the flute where sound is produced by the refraction of the air stream on the mouth piece), the element that creates the tone is the same in both singers and flautists, namely the air stream. Besides, there are also aesthetic reasons for introducing the vibrato of singing into this discussion.

It is interesting to see that, as discussed in Chapter 1, singers have always led the constantly changing vibrato sound ideal of the time. One could speculate about the reasons for this. Instrumentalists have always been taught to try to imitate a good singer when attempting to use vibrato, perhaps because vibrato production in singing is seen as the most “natural”, because the least amount of external muscular control is applied when compared to other instruments.

Since the air stream is important in all wind instruments, instruments such as the flute share with singers the physiological support of the air stream and elements of playing and vibrato production. As both a singer and a flautist, the author has experienced these similarities at first hand. If the key to a clear and constant tone is a constant and supported air stream on both these instruments (the voice and flute), it is only natural that

the physiological origins of the air stream/breath will be identical. The muscles that come into play during the breathing process (inhalation) and support of the tone (exhalation) are identical and the author has therefore referred to singing literature for the discussion on the physiology of the abdomen and thorax in the breathing process and support of tone in Chapter 2.

As previously discussed in Chapter 1, we are aware that as early as 300 years ago there were contrasting theories as to whether the use of vibrato (on all instruments) was acceptable or not. A fascinating bit of research was done by Edison Laboratories in 1921. Thomas A. Edison stated, “If this defect could be eliminated, nothing would exceed the beauty of the human voice, but until this is done there will only be a few singers in a century, who can emit pure notes in all registers” (cited in Westerman 1938:48).

Edison had his agents make recordings of about 3800 singers in Europe and America and found only 22 singers who were capable of singing without vibrato. It came as a shock to Edison that vibrato, something that he saw as a defect, was present in the majority of these singers. These kinds of results led to new scientific studies regarding the physiology of the production of vibrato in singers.

The motor unit response theory

During 1930–1940, research into vibrato concentrated on two different fields: Firstly, the remarkable work of Carl E. Seashore at the University of Iowa’s psychology laboratory, which dealt mainly with the evaluation of vibrato as interpreted from stroboscopic records. Secondly, research done in physiology laboratories in France, Germany, Belgium and the United States. (Specifically referring to the research done at the University of Michigan under the guidance of Professor Kenneth N. Westerman)

For an understanding of Westerman’s findings, a few concepts will be clarified regarding muscle innervation:

- The muscles in the human body are all grouped into smaller muscle fibres, which are connected by single nerve fibres to the central nervous system.
- Each of these muscle fibre groups are referred to as a motor unit.
- The number of motor units in a muscle depends greatly on the size and function of the muscle.
- When the human body assumes a posture (as would be done when a note is produced by a singer or flautist), the central nervous system maintains that posture by sending electrical impulses to the motor units in the muscles involved.
- The number of electrical impulses is determined by the severity of the strain on the muscle.
- When the body is kept in a certain posture by these involuntary action currents, the muscles are said to be in a condition of *tonus*.
- When the body voluntarily contracts muscles, the action currents will be sent faster than it would be in a state of *tonus*, and these muscles are seen to be in a state of *tetany*.
- If all the muscles involved in the production and support of a tone on the flute or with the voice are in a dynamic¹¹ balance, these muscles will be in a state of *tonus*. This is the desired muscular state for performing musicians. If, however, there is any superfluous strain (e.g. stiff shoulders, or rigid wrists), the muscular structures involved will be in a state of *tetany*, and the production of a natural sounding tone will be impossible.

From the studies of the Iowa Group (Seashore), the findings published by Sherrington in 1915, reports by Smith of Harvard, Rijlant of Brussels, and Gomez and Lévy from France, Westerman was able to determine that the average number of electrical impulses sent to muscles in a state of tonus is five to seven per second, the exact same rate as the average pitch vibrato pulsation (Westerman 1938:49). He further writes:

¹¹ The term *dynamic* is used specifically, since this state of tonus will have to be constantly recreated, and flautists should try and maintain stability whilst guarding against any form of rigidity or tetany (when strain is put on muscles to keep certain postures or when muscles are contracted consciously), which would in actual fact inhibit the flautist from creating a natural tone.

... we can see with clarity that vibrato is the effect upon tone of this neuro-muscular rhythmic pulse from the central nervous system made possible only when the physiological conditions of tone production are perfect enough to release and maintain that rate (Westerman 1938:49).

For the first time, both scientists and musicians came to realise that the fact that the majority of singers had a vibrato of the same rate and extent pointed to the possibility that the source of vibrato could be something other than purely expression.

To find a human being singing acceptably without vibrato would be like searching for a human being living normally without breath pulse or heart beat, for posture cannot be maintained or muscles used in condition of tonus and tetany of moderate sustained contraction type without the action currents of the muscular and nervous system being at vibrato rate (Westerman 1938:48).

These studies proved that when the muscular structures involved in breathing and supporting a tone were in their most natural balance, a state of tonus, action currents will be sent at a rate of five to seven messages per second that will in turn result in a vibrato rate of the same frequency. It is important that this frequency of vibrato is not only the average, but also the most desired frequency, because it is the most pleasing to the human ear.¹² One has to ask whether this is a mere coincidence or whether this is perhaps a product of our evolution as a species.

It is obvious that all singers (and flautists) are incapable of singing in a balanced state of tonus. Elements such as poor skeletal posture, fear and hysteria, for example, could cause the muscular structures to be in a state of tetany, resulting in an unnatural vibrato (faster or slower than the desired five to seven cycles per second) due to an increased number of electrical impulses being sent. What this does prove, however, is that the theory that vibrato is something unnatural, that is produced by straining or adding tension to the voice, is invalid. In fact, when the voice is at its most beautifully balanced position, the most natural sounding vibrato will occur.

¹² The scientific studies done on the perception of vibrato will be referred to in Chapter 2, dealing with more studies done by Seashore.

Similarly, when a flautist plays with the correct amount of dynamic balance in his or her muscular support structure whilst supporting the tone, the same state of tonus will occur, and, due to the action, currents will result in the most desired frequency of vibrato.¹³ Higher or lower frequencies are then reserved for special purposes.

2.2 The physiology of the throat structures involved in the production of vibrato

As previously discussed, the role of the larynx in the production of flute vibrato has been vastly underestimated. It has been thought thus far that the primary role of the larynx was phonation, which would imply that it is only used to produce speaking and singing sounds. Recent studies by Brown (1973), amongst others, have proved the opposite to be true. Although there are three clearly distinctive types of flute vibratos, namely, lip, throat and diaphragm vibrato, these three are not independent of each other and, even when a flautist believes that they have a primarily diaphragmatic vibrato, it is possible that there is parallel motion of the vocal folds and/or lips.

According to the research by Brown, the only muscles in the throat that we are able to control are those of the constrictor muscles in the pharynx, which are primarily involved in swallowing. Although there is thus, strictly speaking, no muscle in the throat that can actually be controlled in the production of vibrato, it still seems possible to manipulate the throat structures to create pulsations in the air stream used in playing the flute. Brown states, “While one cannot observe the muscle activity directly it can be deduced by observing the related structural movement” (1973:12).

¹³ This description of vibrato applies to all cultures in which a “natural” sound is the ideal.

2.2.1 An empirical study of the physiological aspects of throat vibrato

It is the belief of the author that one will only be capable of exercising absolute control over the muscles involved in the vibrato production process once one understands exactly which parts of the body are involved in this regard. Only then can one attain full control over vibrato. In that respect, this section will rely on a doctoral dissertation written by Andrew Brown (1973), *A comprehensive performance project in oboe literature with a cinefluorographic¹⁴ pilot study of the throat while vibrato tones are played on the flute and oboe.*¹⁵

To begin with, Brown (1973:1) writes the following, which is provided here as endorsement of the present researcher's views as expounded above:

Although the production of an acceptable throat vibrato does not depend on knowledge of the anatomy and physiology of the throat, an understanding of the structures of the throat and their functions can help to correct misunderstandings and misinformation about vibrato production and can also help to provide better methods for teaching throat vibrato.

2.2.2 The throat structures

Brown thus points out that it is useful to become better acquainted with certain structures of the throat (i.e. its anatomy) and their respective functions (i.e. their physiology).

In order to illustrate the structures involved in the production of vibrato, the researcher has used her own sketches base on the anatomical sketches of Dr. Frank Netter (1997).

¹⁴ Cinefluorography is a method where the use of a movie camera produces fluoroscopic views, especially of the heart and great vessels or gastrointestinal tract, after the administration of a contrast medium.

¹⁵ The purpose of the study is to demonstrate that cinefluorography is a valid tool for investigating the physiology of the throat during production of vibrato and vibrato-less tones on the flute and oboe.

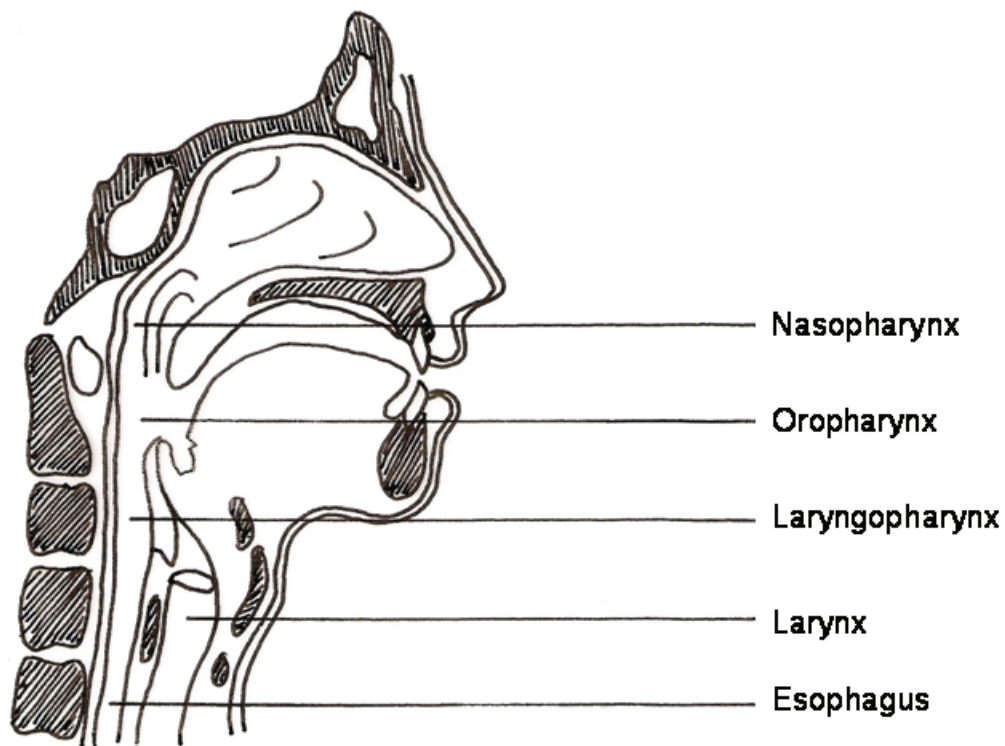


Figure 1 **The principal throat structures**

As demonstrated in the figure above, the principal throat structures are the pharynx, which in turn consists of the oropharynx and the nasopharynx, and the epiglottis, which prevents air from entering the oesophagus and averts food from entering the larynx. The pharynx connects the nasal and oral passages to the larynx and the oesophagus and is situated in the throat proper, while the larynx and oesophagus are situated in the upper chest cavity.

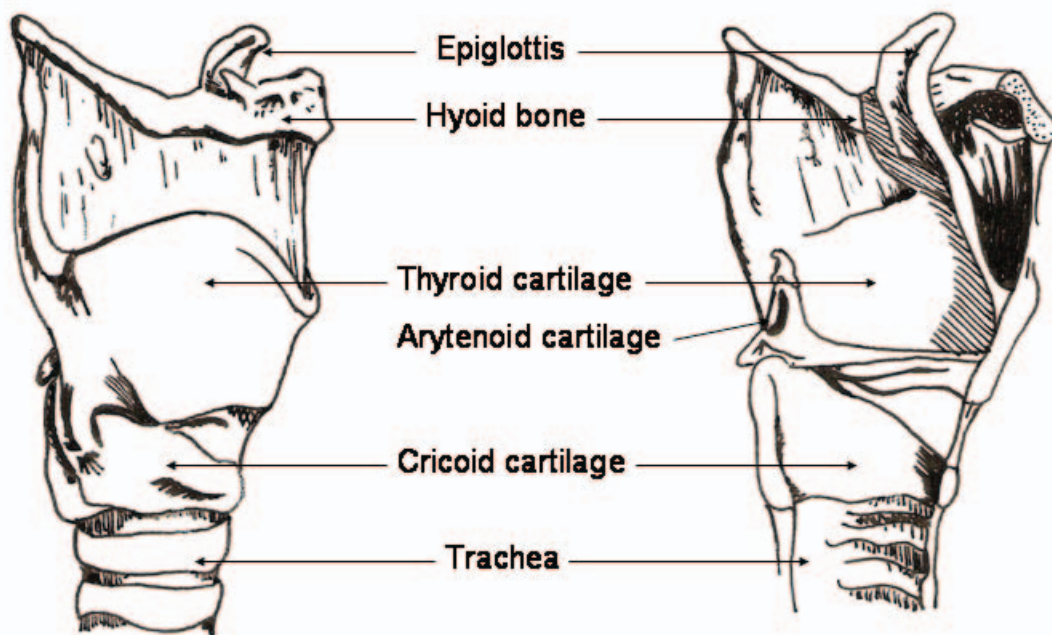


Figure 2 The larynx

The larynx (see Figure 2 above) is the most complex of the throat structures. It is made up of a number of cartilages connected by muscle tissue, namely the thyroid cartilage, the cricoid cartilage and the epiglottis. These structures are connected to each other and to the hyoid bone, from which the larynx is suspended. The tongue is also connected to the hyoid bone and causes the larynx to rise and fall. Within the cartilage structures are the arytenoid cartilages, which are able to move in a variety of ways. They can glide medially¹⁶ and laterally as well as rotate, and may slide forward and backward with restricted movements (Brown 1973:02).

The vocal folds (or chords) are attached to the arytenoid cartilages at the back of the larynx and to the thyroid cartilage at the front. They are opened and closed by action of the arytenoid cartilages and are both used as a “valve” to stop air from escaping from the

¹⁶ This term implies movement towards the midline of the body.

trachea and to produce speaking and singing sounds. The opening between the vocal chords is called the glottis. Above the vocal folds are the false folds. The space between the false and true folds is the laryngeal ventricle (Brown 1973:03).

The muscles in the larynx are named after the cartilages or bones which they connect. The muscle connecting the epiglottis to the arytenoids is called the aryepiglottic folds. The cricoid cartilage is connected to the arytenoids by the cricoarytenoid muscle. There are four main muscles or muscle groups that are involved in controlling the vocal folds, and therefore the production of vibrato:

1. The posterior cricoarytenoid muscles
2. The lateral cricoarytenoid muscles
3. The cricothyroid muscle
4. The thyroarytenoid muscle

Furthermore, these muscles influence the vocal folds in different ways (see Figure c and d below). The *posterior cricoarytenoid muscles* move the arytenoid cartilage in a rocking motion posterolaterally over the rim of the cricoid cartilage, thus opening the vocal folds. The *lateral cricoarytenoid muscles* draw the arytenoid cartilages anteriorly, shortening the vocal folds when they are held in adduction,¹⁷ and may cause slight rotation (see figure 3) of the arytenoid cartilages, pressing the two vocal folds together (Brown 1973:4-5).

¹⁷ Adduction is the movement of a body part toward the central axis of the body.

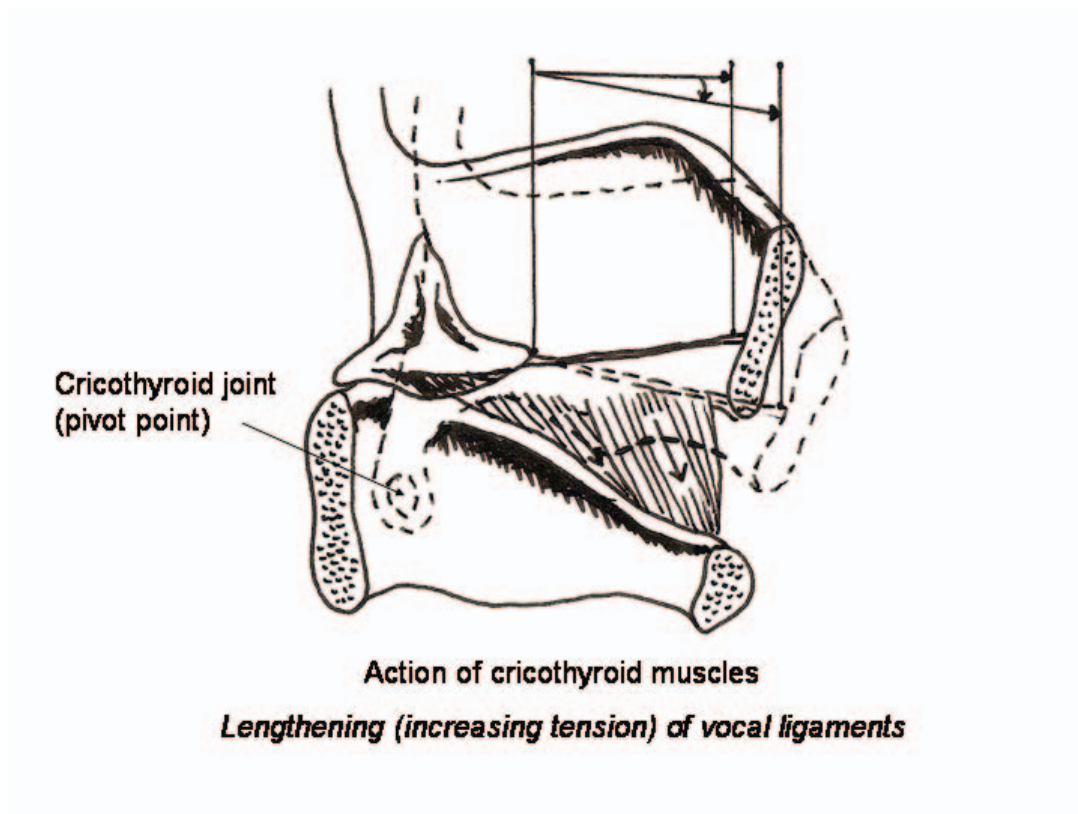


Figure 3 **The action of the cricothyroid muscles**

The *cricothyroid muscle* lifts the anterior arch of the cricoid cartilage, tilting the top of the lamina¹⁸ posteriorly,¹⁹ thus lengthening the vocal folds. It may also move the cricoid cartilage posteriorly in relation to the thyroid cartilage. The lateral portion of the *thyroarytenoid muscle* may shorten the adducted folds' biologic and phonatory purposes.(see in figure 4) The medial portion may aid in tension regulation for phonation (Brown 1973:4-5).

¹⁸ This term refers to a plate or a layer. For example, the lamina arcus vertebrae, or just lamina, are plates of bone in each vertebral body.

¹⁹ This term refers to the back, as opposed to the anterior.

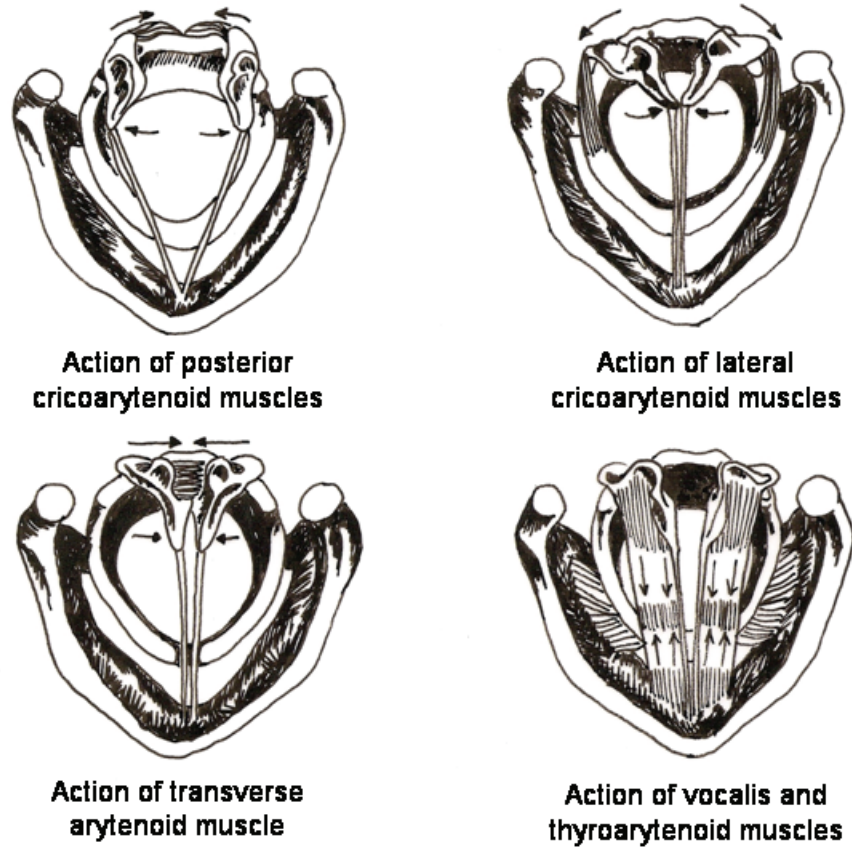


Figure 4 The action of different muscles in the throat

2.2.3 Brown's cinefluorographic tests

2.2.3.1 Procedure

For his research, Brown had cinefluorographic films taken of six participants while they were producing vibrato on their instruments. The participants²⁰ were faculty members and students of the University of Iowa School of Music. All the participants believed that they were using throat vibrato, and could commence and arrest their vibrato at will. They were each asked to play *d* above *middle c*, hold it for four beats without vibrato, four

²⁰ They included an oboe instructor, a flute instructor and a Master of Fine Arts candidate in oboe, one graduate and two undergraduate flute students.

beats with vibrato and again for four beats without vibrato (as shown below). No dynamic level was prescribed²¹ (Brown 1973:6).



2.2.3.2 Observations²²

The motion of the larynx in both the vibrato and non-vibrato sections were compared and analysed. This visual analysis, in conjunction with graphs based on the measurements that were obtained, indicated that there was structural motion in the throat, specifically in the larynx, when vibrato was used. Movement of the arytenoids, aryepiglottic folds and laryngeal ventricle was clearly visible in some cases. This motion was, however, absent when the note was played without vibrato (Brown 1973:10).

Brown's study was the first to make use of cinefluorography to determine what effect the production of vibrato has on the different structures of the throat. Based on the results that were obtained, the following conclusions could be drawn:

1. The air column is modulated by the vocal folds.
2. A variation of intensity (volume) appears to be resultant of throat vibrato.

It would therefore appear that the vocal folds are the main structure involved in producing throat vibrato. It is, however, important to emphasise that the vocal folds are only able to fluctuate in shape and movement when the throat muscles are contracted, resulting in movement of the cartilages that are connected to the vocal folds. Brown added that, although muscle activity cannot be directly observed, it can to a great extent be deduced from observing related structural movement (Brown 1973:12).

²¹ It was thought that participants might play with an unnatural vibrato if they were asked to produce certain dynamics. A loud dynamic level, such as *forte*, would perhaps have forced them to employ a wider vibrato, while *piano* might have forced participants to employ a smaller vibrato.

²² The cinefluorographic films that were made of the participants were examined by Brown, an anatomist, two radiologists and a speech pathologist.

2.3 The physiology of the abdominal muscles and their use in vibrato production

2.3.1 Introduction

The reference to the role of the diaphragm in the production of vibrato is consistent in most treatises written on the flute. The general consensus amongst flautists is that there are three different ways to produce vibrato. The first is by using the lips, something that is rarely discussed, except when referring to the uncontrolled effect that it has on the vibrato. This technique seems to have disappeared from flute pedagogy altogether. The second is by using the throat, which is also discouraged, because it usually results in a “nanny goat quiver” vibrato²³ when attempted by beginners. However, the fact that the throat (larynx and all associated muscles) vibrates in sympathy to a pulsating airflow is undeniable. (Refer to previous chapter, dealing with these structures.) The third source that vibrato originates from is the diaphragm. The general consensus amongst flautists is that this is where the “support” for producing a tone stems from and, since it is the supported airflow that creates the tone, it would be the logical deduction that whatever supports the tone, once vibrating, would create a pulsating tone, in other words, vibrato. The author therefore felt it necessary to discuss the abdominal muscles and their role in “supporting” a flautist’s sound, since these would be the exact muscles related to the production of vibrato.

Treatises on flute playing rarely delve deeper into the physiology of breathing and tend to refer only to the concept of “supporting” with the diaphragm. This is, ironically, an incorrect term, since the diaphragm is not a voluntary muscle. Frederick Husler and Yvonne Rodd-Marling accurately states, “The diaphragm must not be moved by an alien force – its own strength must move it. It must ‘do’ – not be ‘done to’; it must act itself – not be acted upon” (Husler et al. 1965:44).

²³ Common vibrato problems such as the “nanny goat quiver” vibrato will be discussed in greater detail in Chapter 5, referring to the teaching methodology of vibrato.

This means that if all the muscles in the flautist's chest and abdomen are correctly aligned and in harmonious tonus,²⁴ therefore resulting in a dynamic equilibrium, the diaphragm will, as a result, support and/or vibrate in sympathy with all the other abdominal muscles, but the diaphragm itself cannot flex, contract or support the tone solely on its own.

James Galway humorously writes, "I think it is made unnecessarily difficult by technical descriptions, especially glib references to the diaphragm, which could be down the left side of his pants for all the average ten-year-old knows to the contrary" (1982:70).

Although a thorough understanding of the physiology of the abdominal muscles may not be necessary for a beginner to be able to learn to play the flute, once flautists reach the stage where they start applying vibrato, it seems essential not only to know how these muscles function, but also how to control and strengthen them through exercises.

Due to the lack of knowledge regarding the physiological detail of the muscle structures involved in breathing whilst playing the flute, the author has referred mostly to treatises written on the breathing methods of singers. The singing of a note makes use of the same energy source as the production of a note on the flute, in the sense that both require a ready flow of air. Since the same muscles are used to produce and control the airflow in the flute and the voice, the research done on the physiology of the "breathing organ" can be made applicable to the flute, but is unfortunately rarely utilised. The only difference between these two instruments is of course the role that the larynx (consisting of the vocal folds and ventricular bands) plays in the production of sound in the singer. Whilst it is this exact subglottic pressure that results in the production of sound, it is the actual refraction of the air stream on the flute's mouthpiece that creates the sound of the flautist. This indicates the importance of the embouchure and positioning of the mouth in the production of sound, but since we are discussing breathing and support, the important thing is controlling what happens in the body itself before the air even leaves the mouth

²⁴ The word tonus refers to the muscles being held in a certain position, without creating strain on any part of the body. (Refer to Chapter 2.1 and the motor unit theory.)

(or larynx for that matter). Nancy Toff describes the concept of “support” in her book on the flute as follows: “The ability to control exhalation with the lungs and abdominal muscles before the airstream ever reaches the embouchure, much less the inside of the flute, is essential” (1996:81).

It is thus with the ideal of creating a better understanding of the abdominal muscles involved in supporting tone and creating vibrato that the author felt it necessary to include the following chapter.

2.3.2 The three types of breathing

According to Toff, it is necessary for flautists to be able to perform three types of breathing, namely long breaths, medium breaths and short or reinforced breaths (1996:85). Galway refers to them as deep breath, bridge breath and snatched breaths (1982:75).

The deep breath’s function (as in all of the others) is to replenish the air in the lungs of the flautists, but because this type of breath separates musical phrases, it should be used only at appropriate times, for example the beginning of a piece or when rests are indicated. Galway even states that he

...breathes in composedly to fill the lungs almost to capacity, then I pause just to make sure everything is in order and ready to go, and at the last moment I take a further snifter of air on top, so that with all the oxygen inside me I can really steam along (1982:75).

The bridge breath replenishes flautists’ air supply when they do not have sufficient time to take a deep breath. This type of breath should be snatched at speed so that it does not interfere with the phrasing of a piece.

Lastly, the short, snatched breath is appropriate to use in situation where flautists need to breathe when the music does not supply them with sufficient time to take a deep or bridge

breath. A good example of where these micro-breaths would be appropriate is in between short, repeated staccato notes.

In all of these types of breathing, the exact same muscular structures are involved. This stage in the breathing process is called *inspiration*, the intake of air.²⁵

2.3.3 Posture

For the muscular structures involved in the support of a note (and therefore the production of vibrato) to function at its optimal, flautists need to have the correct posture. Without the correct alignment of the framework of our bodies (the spine and ribcage), the muscular tissue connected to these bones will be unable to function at its optimal capacity.

Meribeth Bunch defines good posture in her *Dynamics of the singing voice* (1982) as follows:

The body is aligned efficiently when a plumb line can be shown to fall from the top of the head through the ear hole (external auditory meatus), the middle point of the shoulder (acromion), the highest point on the iliac crest, the knees, and just in front of the ankle. (1982:25).

The figure below demonstrates clearly the correct postural alignment of the skeleton.

²⁵ The second and third stages of breathing will be discussed in 2.3.4.

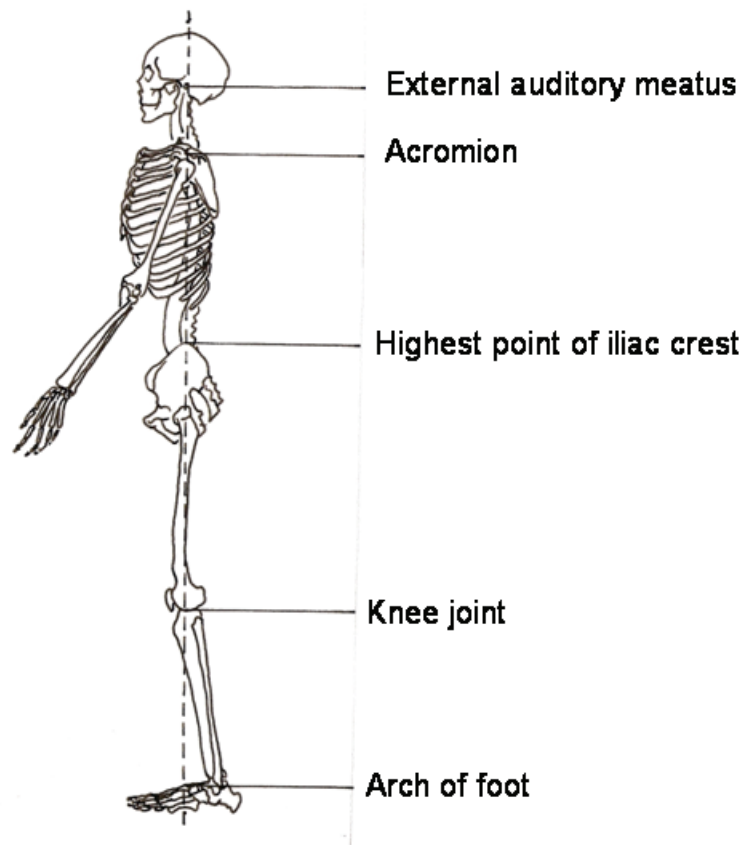


Figure 5 **The correct posture**

If a flautist does not maintain the correct posture, a large amount of energy is wasted in trying to maintain this faulty alignment. Secondly, bad posture hampers the movement of the ribs and chest, which would directly result in ineffectual breathing techniques. Thirdly, when a flautist's body is not aligned, it is important to realise that the stress caused in these muscles will be transferred to other parts of the body, resulting in an inability to create a natural, singing tone, necessary in the production of vibrato. Lastly, Toff refers to the magician Houdini when discussing breath control, comparing the amount of movement that he permitted himself when attempting an escape routine to that which flautists should allow themselves whilst playing. Every unnecessary motion during performance uses energy that could be utilised in their playing. It is therefore these two elements, posture and discipline, that are most crucial to the development of adequate breath control.

At present, there is a school of thought advocating exactly what has been stated above, namely the followers of the so-called *Alexander Technique* (as cited in Bunch 1982:27). F.M. Alexander was a singer during the late nineteenth century, who encountered severe problems due to his incorrect posture, since he had the mannerism of tilting his head back, causing more stress on the neck muscles and larynx than necessary. By trial and error, he found that certain positioning and aligning of the body's structures would reduce his problems dramatically, and others would increase the problems he was experiencing. In these experimentations, he noted that most of the new techniques he was applying felt uncomfortable and unnatural at first, but that he got used to them after a while and that they drastically improved his ability as a singer. Alexander describes the ultimate posture as follows:

...with the head held high as if floating, with the crown of the head pointed to the ceiling, and the spine like a string attached to the head, and with arms and shoulders relaxed, gravity would help to keep the body in alignment with no need for great muscular activity. This freedom of alignment allows the body to use its energy far more economically and is especially efficient because no tiring or undue tensions are present (cited in Bunch 1982:30).

There are also factors that seem trivial, but could have an immense influence on a student's posture, the most important being the positioning of the stand, whether the student is sitting or standing. It is extremely important to keep in mind that the stand should be adjusted once the perfect posture has been assumed, and never the other way around.

Once a flautist is able to maintain this perfect state of alignment, where all the abdominal structures would be in ideal tonus, a natural vibrato should ensue without any great difficulties.²⁶

²⁶ Refer to the *motor unit theory* in 2.1.

2.3.4 The three stages of breathing

Inhalation

The main objective of inhalation for flautists is to try to fill their lungs to maximum capacity, allowing their torso to expand to the front and back whilst keeping the rest of their body, especially the shoulders and chest, stationary. It is completely natural for the abdomen to extend somewhat while this is done.

According to previous misconceptions, it was believed that it is the diaphragm that protrudes when it is completely relaxed (Galway 1982:71). Numerous physiological studies have shown, however, that it is in fact the liver and stomach that are pushed down by the diaphragm, creating the slight bulge that is noticeable. Other sources note that inhalation occurs when the diaphragm contracts, to create a vacuum in the lungs (Toff 1996:82), which is not entirely correct. It is a far more complicated process than one set of muscles working to inhale a single breath.

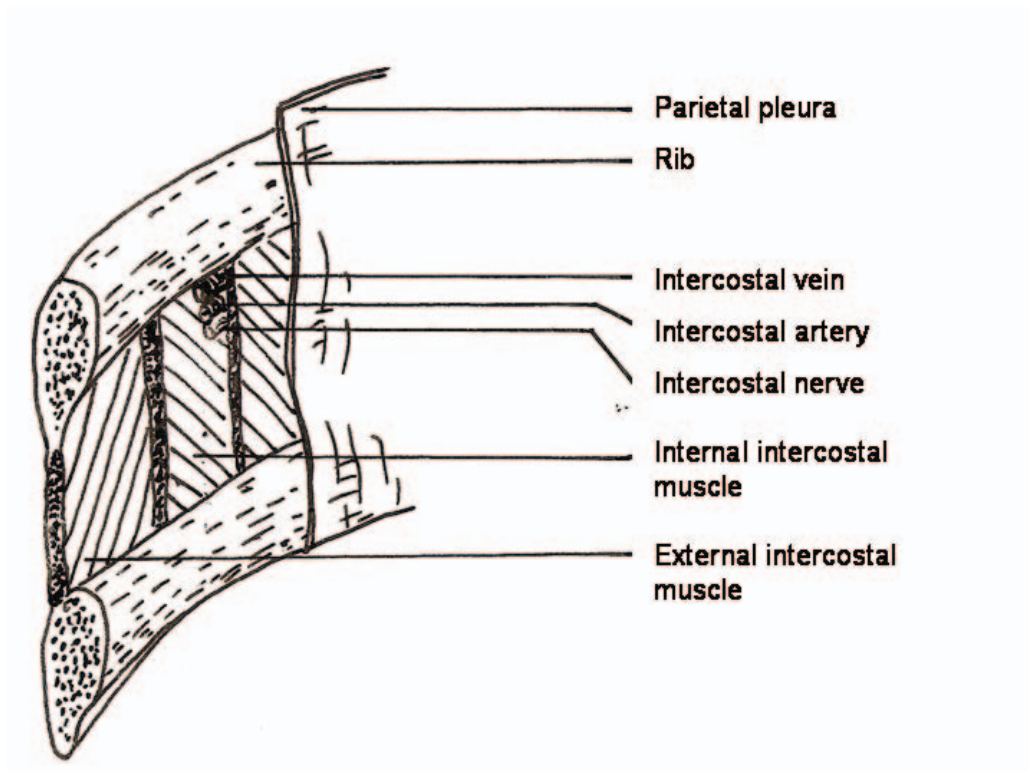


Figure 6 The dissection of 2 ribs and the intercostal muscles

The first and most important set of muscles that is involved in the inhalation process is the intercostal muscles (see figure 6), the muscles present between each rib. The intercostals muscles consist of the internal, innermost and subcostal muscles. These muscles, along with the *levatores costarum* muscles (see figure 7), are responsible for the elevation of the ribs, which in turn will result in the diaphragm being able to contract at the same time.²⁷ These two groups of muscles are called the “prime movers” and are assisted by the secondary muscles, which are responsible for stabilising of the ribcage and aid in posture without interfering with the process of inhalation (Bunch 1982:34). Lastly, the prime movers and secondary muscles are also assisted by the *scalene* and *sternocleido-mastoids* (neck muscles, see figure 8), which assist both in the process of inhalation and the maintaining of correct posture.

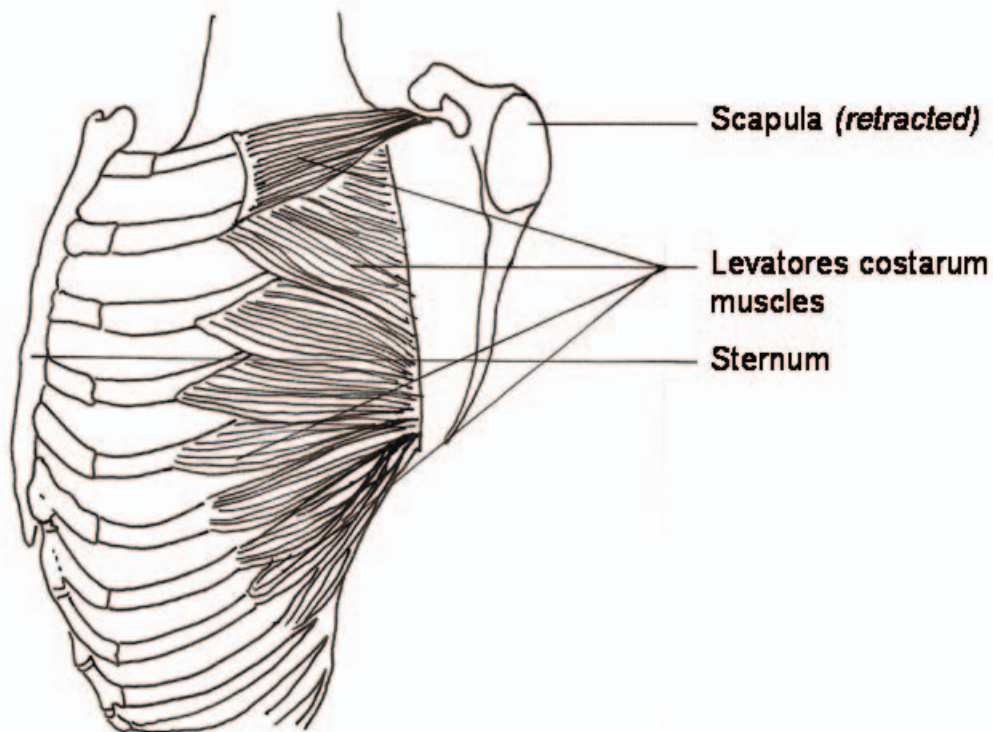


Figure 7 **The levatores costarum muscles**

²⁷ It is for this reason that flautists are encouraged to do aerobic exercise, something that would strengthen these muscles, swimming being the best sport, due to the added control of breathing that is necessary to be a proficient swimmer and flautist (Toff 1996:83).

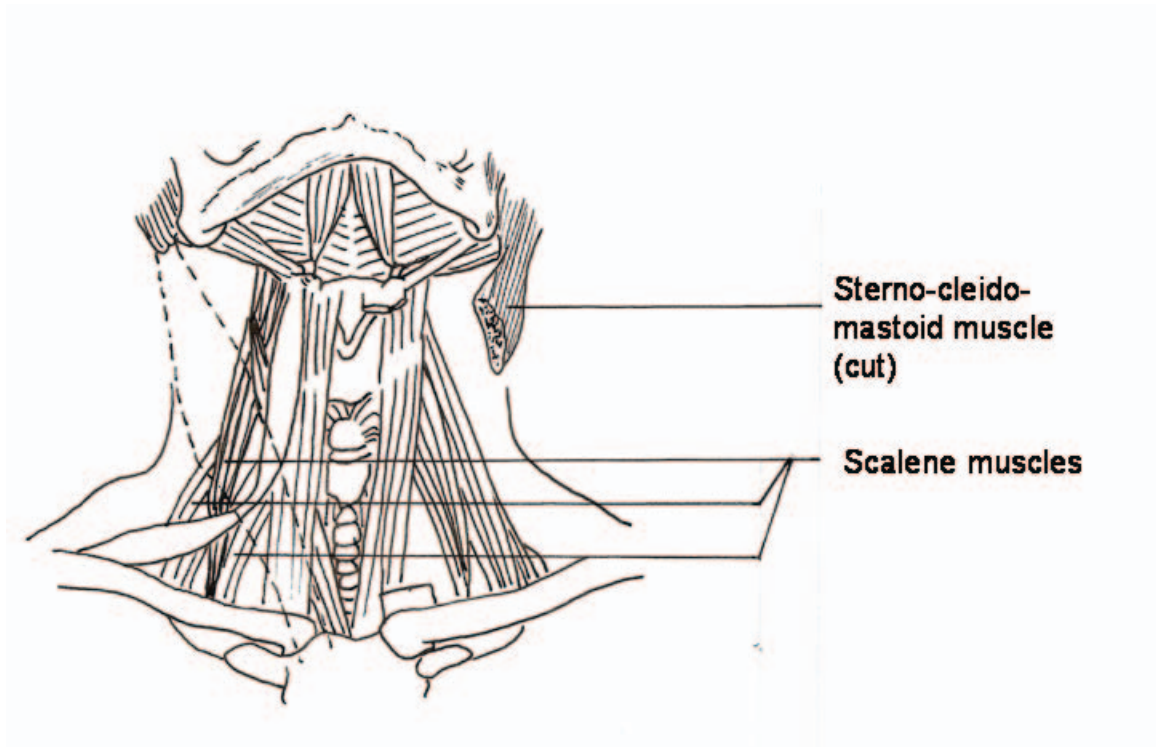


Figure 8 **The muscles of the neck involved in breathing**

The process of inhalation does not play a significant role in the production of vibrato, but is included due to the importance of its role in the breathing process. Without inhaling correctly, the equilibrium required for a natural muscle tonus cannot be met, which in turn would also make it near impossible to create a natural sounding vibrato. Every mistake that is made during the breathing process will result in strain being put on other parts of the body, and these stresses can result in a flautist playing with a rigid diaphragm or protruding stomach, for example,²⁸ which would make it more difficult to produce vibrato.

Suspension

Although brief, this stage is as important as inspiration and expiration. The duration of this stage is rarely longer than a few milliseconds, in which flautists prepare themselves

²⁸ Problems that may occur due to incorrect breathing methods will be discussed in 2.3.9.

for the expiring stage of breathing. It is important to focus on two things whilst this stage occurs, namely to keep the throat open and the torso expanded. If a flautist is not constantly aware of the relaxation and flexing of their support structure (abdominal muscles) during this stage, it could result in hyperventilation and dizziness, a breathy tone, sharpness in pitch and a tone that is breathy and quickly loses resonance. The main aim of this brief suspension is to allow the abdomen's muscles to provide support that will then last for the full duration of the following tone that is produced (Toff 1996:82).

Exhalation

This stage is usually disregarded when breathing is studied because it is involuntary and relatively passive. For wind players, however, this is seen as the active stage, the phase that requires the most control and skill.

A flautist is able to maintain control and support a tone by the delicate balance that is held between the diaphragm, the abdominal wall and the chest cavity. All muscles whose actions tend to diminish the size of the thorax are considered expiratory. The most important and powerful muscles implicated in the expiration process are the external and internal *oblique* muscles and the *transverses abdominis*, all of which are connected to the ribcage or the iliac crest (highest part of the pelvis, see figure 9).

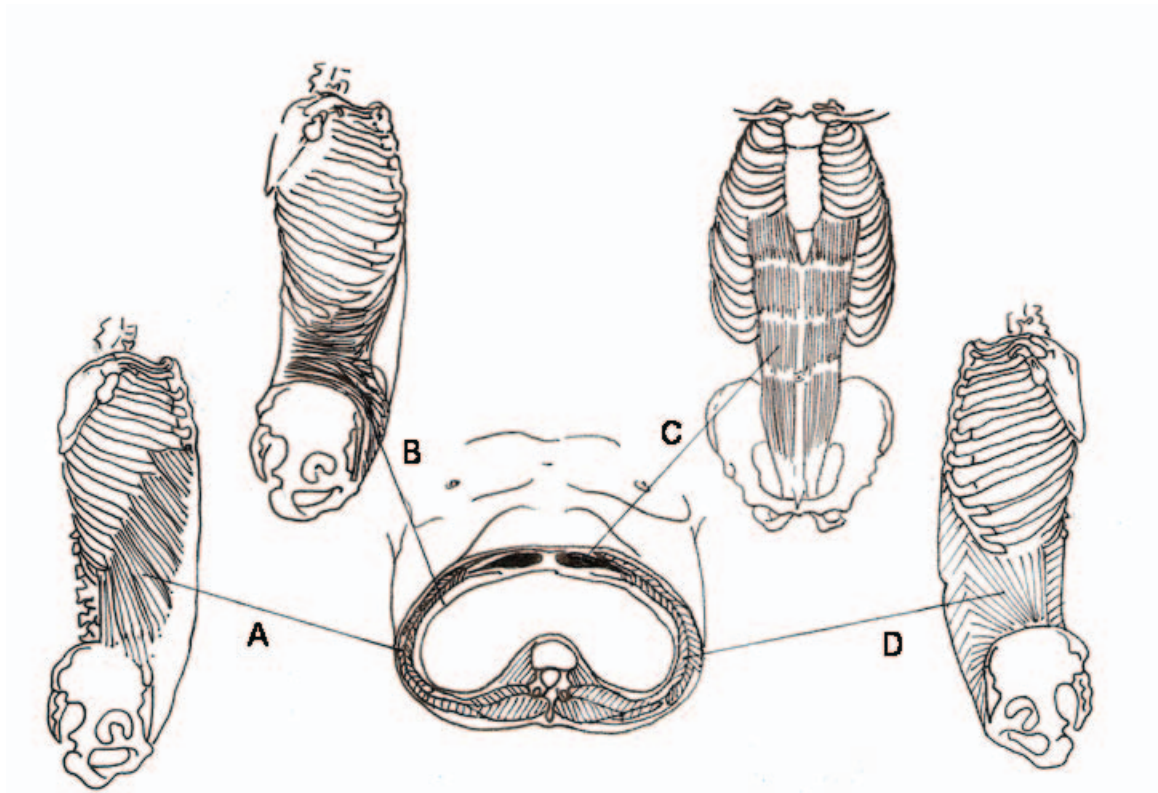


Figure 9 The external *obliques* (A), internal *obliques* (D), *transverses abdominis* (B) and *rectus abdominis* (C).

By contracting the three pairs of sheet muscles simultaneously, the intra-abdominal pressure is raised in the same way as when one is lifting something heavy or holding your breath. The same action should occur when someone plays a note on the flute, resulting in the action being supported by the same muscular structures.

Bunch also states that, in addition to the important action of the abdominal muscles, the external and innermost intercostals (with the exception of the parasternal portions) and subcostals all act in expiration by diminishing the size of the thorax. The pelvic floor (consisting of multiple muscles on the floor of the pelvis) acts as antagonist to the diaphragm (see figure 10) and is therefore seen as a necessity in the process of expiration.

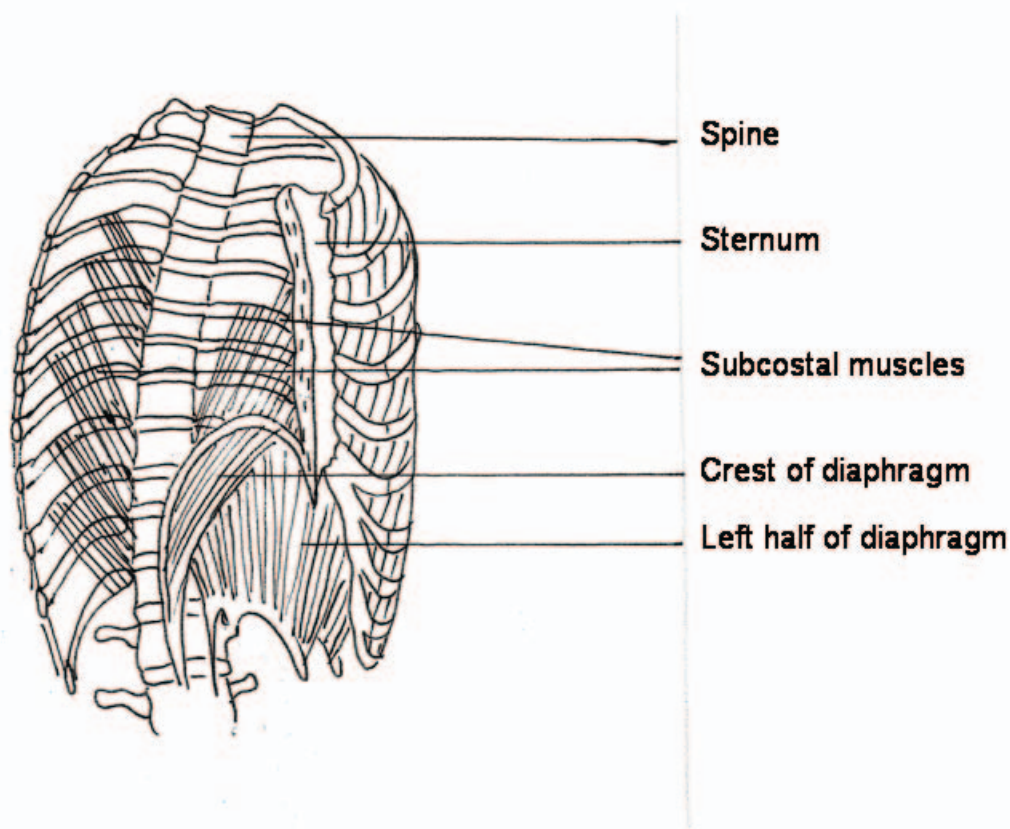


Figure 10 The diaphragm

Lastly and most importantly, Toff reminds flautists to keep their ribcage wall expanded, simultaneously allowing the abdominal wall to contract towards its rest position. As the abdominal muscles press against the base of the lungs, the air will be forced out, but due to the expanded ribcage wall, there will always be a modest amount of air left. Only once the abdominal cavity is expended, can the ribcage muscles be contracted. She further mentions that the chest cavity should be seen as a reserve tank, only used when absolutely necessary (Toff 1996:83).

2.3.5 The nose

McKinney states in his *The diagnosis and correction of vocal faults* (1982) that the nose is designed to filter, warm and add moisture to the incoming air. In order to perform these actions, it is also constructed to slow the air down as it is inhaled. It is beneficial for

flautists to realise this so that breathing (specifically inspiration) always occurs through the mouth and never the nose. If inspiration occurs through the nose, the amount of air as well as the speed with which it can be inspired will be greatly diminished.

2.3.6 The epigastrium

McKinney also refers to an area in the upper abdomen, just below the breastbone (sternum), bounded on both sides by the ribcage, which he refers to as the epigastrium. He notes that the importance of this area can be overemphasised and that its action can be exaggerated, but still presents the singer with an exercise that would enable them to come to a better understanding of this structure and its function.

He asks the singer to place their fingers on the soft part of the abdomen, just below the sternum. He subsequently asks that the singer cough, talk and say a few over-exaggerated “hi’s”, first softly and then loudly. It is normal to feel the reflex action of the epigastrium against one’s fingers. Even when you are talking softly, you should feel the gentle firming of this wall going outward.

The problem that the researcher has encountered, however, is that this is the only work in which the term epigastrium has been encountered. In no other work is there any reference to the importance of this area, and when consulting Netter’s atlas of anatomy, the area that McKinney refers to appears to consist of the *rectus abdominis* muscle, enclosed by the *linea alba*.

The fact that this area is active in the production of tone, whether in singing, playing the flute or mere phonation, is undeniable, and therefore the author felt it necessary to point out its importance.

2.3.7 The diaphragm

As mentioned in the introduction to this chapter, there is a large misconception about the role of the diaphragm in breathing, phonation, playing the flute and generating a vibrato.

Galway mentions an exercise to “prove” the presence of the diaphragm in breathing. He asks the flautist to lie on his or her back, with their hands underneath the waist. If another person rests their hands on the flautist’s stomach (where the ribcage curves to the right and left) and the flautist inhales, the second person will feel how the expansion of the abdomen will shift their hands (Galway 1982:71).

Ironically, Bunch states that this is not the contraction of the diaphragm, as we are so often led to believe. It is in fact a much more complicated process in which the diaphragm only contracts due to the thoracic cavity increasing (due to the muscles mentioned in the inspiration stage of breathing), resulting in the flattening of the diaphragm, which in turn pushes the abdominal organs downwards and forwards (Bunch 1982:37).

This may seem like a hypercritical scrutiny of something that has been referred to as diaphragm vibrato for ages, yet it informs the understanding that the action of the diaphragm will always be secondary to that of the *intercostal* and *levatores costarum* muscles.

Toff also states that the diaphragm never pushes the air out of the lungs, which is the role of the abdominal muscles, nor can the diaphragm “support the air column”, which is the function of the abdominal wall and ribcage (intercostal) muscles. She further states:

Support is the isometric action of tension between the diaphragm and abdominal muscles, which controls the rate and pressure of air release. The faster the airspeed, the higher the pitch and the more edge or pointedness to the tone quality. By contrast, the slower the airspeed, the lower the pitch and the more diffuse the quality of the tone. Thus, for advanced players, a

technique known as diaphragm flexing (but actually diaphragm-abdominal isometric exercise) is an auxiliary method of varying tone colour and dynamics (1996:83).

Husler et al. further explain that it is in effect the counter movement of the diaphragm, and not the contraction, that results in the feeling of support flautists refer to. In other words, during the exhalation process, it is not the relaxation of the diaphragm that creates the diminished pressure in the thorax, but the contraction of the diaphragm (the retaining of its position during inhalation) that is sustained during exhalation which creates the feeling of support.

They further explain that:

[It is] the *active* tension (contraction) of the diaphragm [that] gradually diminishes while singing; its *tonic* strength, however (tone in the constant tension present in organic bodies), progressively rises, so that breathing in needs no conscious act; it follows automatically (Husler et al. 1965:38).

As already mentioned, Husler et al. also stress the fact that the diaphragm function is secondary to the other primary muscles involved in the breathing process: “The impetus that sets the whole process in motion comes from the back, from the powerful origins of the diaphragm and those of the joint back-stretchers” (Husler et al. 1965:38).

2.3.8 The discontinuing of thoracic breathing

Lullies (cited in Husler et al. 1965) mentions that physiologists sometimes refer to the breath used by a singer as the “singing breath” or “artificial breath” when compared to the “natural” breathing of the normal person.

Contrary to popular belief, this correct method of breathing (as described previously) has only started being the norm during the 1950s. Previously, musicians relied on a type of breathing referred to as *thoracic breathing*, a simple way of cramping the breathing organ as well as the whole body. Referred to as the “stomach in, chest out” method by Husler, a

method that solely used the rib (intercostal) muscles to extend the thoracic cavity, which, because the stomach needed to be contracted, resulted in a rigid diaphragm that could not assist in the control of air during the expiration process at all.

Although a heightened understanding of the human body and the physiology of breathing has helped immensely, there are still numerous problems with the relatively new way of breathing, referred to as “deep breathing”. Husler states that specialists in the mechanics of breathing freely admit that their subject requires further research and W.E. Fenn (cited in Husler et al. 1965:49) further explains that “the mechanics of breathing is a problem requiring on one hand the detailed knowledge of a classical anatomist and on the other hand the analytical understanding of the engineer!”

2.3.9 Faults relating to breathing

According to McKinney, there are four methods of breathing that are to some degree inefficient or tension-producing and may therefore be considered breathing “faults” (McKinney 1982:59). He identifies these faults by the portion of the anatomy that is involved, namely upper chest breathing, rib breathing, back breathing and belly breathing.

It is the dynamic balance between the rib muscles, back muscles and abdominal wall that will result in the most efficient and natural breathing. It is therefore imperative for the flautist to understand that any “fixing”, “adjusting” and/or “holding” of their breathing organ²⁹ will result in insufficient breath control, and therefore an uncontrolled tone, which makes it impossible for a natural vibrato to ensue (McKinney 1982:35). The majority of problems related to breathing are due to either a lack of understanding of the above concept, or a lack of knowledge about the physiological structures involved in breathing.

²⁹ McKinney refers to the combination of the lungs, diaphragm and muscles associated with breathing as the “breathing organ” (McKinney 1982:47).

Upper chest breathing

This fault is also referred to as clavicular breathing due to the pronounced rising and falling of the chest. This limits the downward travelling of the diaphragm, wastes energy because of its tiring effect and may also transfer tension to the muscles of the neck and larynx, which could affect the sound of the flautist.

Rib breathing

Although it should be visible that the ribcage expands during inspiration, if this is the sole focus of the flautist, it might result in limited expansion in any other part of the chest and/or abdomen. Tension that is created in the muscles of the chest, ribs and shoulders might also be transmitted to the neck and larynx, as mentioned above, and any unnecessary movement during the breathing process would be seen as physically tiring and therefore a waste of energy.

Back breathing

Back breathing has much in common with rib breathing in that the main function would be to extend the ribcage. However, whilst the extension in rib breathing is to the sides, back breathing aims to extend the ribcage to the back. Once again, there is a slight elevation of the back visible when breathing properly, but when unnecessary effort is made to elevate the back or ribs, the area for frontal expansion is exceedingly limited. Along with the wasted energy and transmitted tension in other parts of the chest, this method of breathing also results in shoulders that are pulled forward, concluding in a weak posture.

Belly breathing

All of the above-mentioned faults limit the diaphragm from travelling downwards, but in the case of belly breathing it is actually the upward travelling of the diaphragm that is prohibited. As previously stated, the slight swelling of the abdomen is normal, due to the liver and stomach being pushed downwards and outwards by the diaphragm contracting. If a student however largely focuses on this part of breathing, the contracted diaphragm will have a more pronounced “bulge” of the abdomen. This not only constricts the

upward travel of the diaphragm during expiration, but will also result in poor posture (sunken chest and protruding abdomen) and will have a severe impact on the limitations of the breath support of the flautist.

Hypofunctional breathing breath support

This fault refers to the failure to demand sufficient activity from the breathing mechanism and is common amongst beginner flautists. The quickest way to rectify this problem is by explaining and demonstrating the three stages of breathing (McKinney 1982:62).

Hyperfunctional breathing and breath support

This fault refers to flautists who demand too much physical activity of the breathing mechanism, which is usually caused by the misconception that the ability to play long phrases is a direct result of the amount of air during inspiration. The fear of running out of breath while performing can also result in hyperfunctional breathing, and can usually be corrected once the flautist realises that it is the support structure that should prevent this from occurring and not the player's lung capacity. Taking in too much air not only wastes energy, but also creates unnecessary tension in both the breathing mechanism and the larynx.

2.3.10 Subglottic pressure

Although literature on the flute does not refer to the pressure caused by the flow of the expired air against partially closed vocal folds (referred to as subglottic pressure by Bunch), it is frequently dealt with in the literature written for singers. This pressure is said to be the main source of generating a tone of constant or increasing loudness (Bouhuys cited in Bunch 1982:52). Rubin, Le Couver and Vennard argue that it also plays a significant role in controlling the intensity of the sound produced by singers (cited in Bunch 1982:52).

Bunch furthermore states that, according to the research of Abo-el-Enene (1967) and Adzaku (1980), "mechanoreceptors in the subglottic mucous membrane are sensitive to

changes in air pressures and exert significant reflex effects on the activity of the intrinsic muscles of the larynx” (Bunch 1982:51).

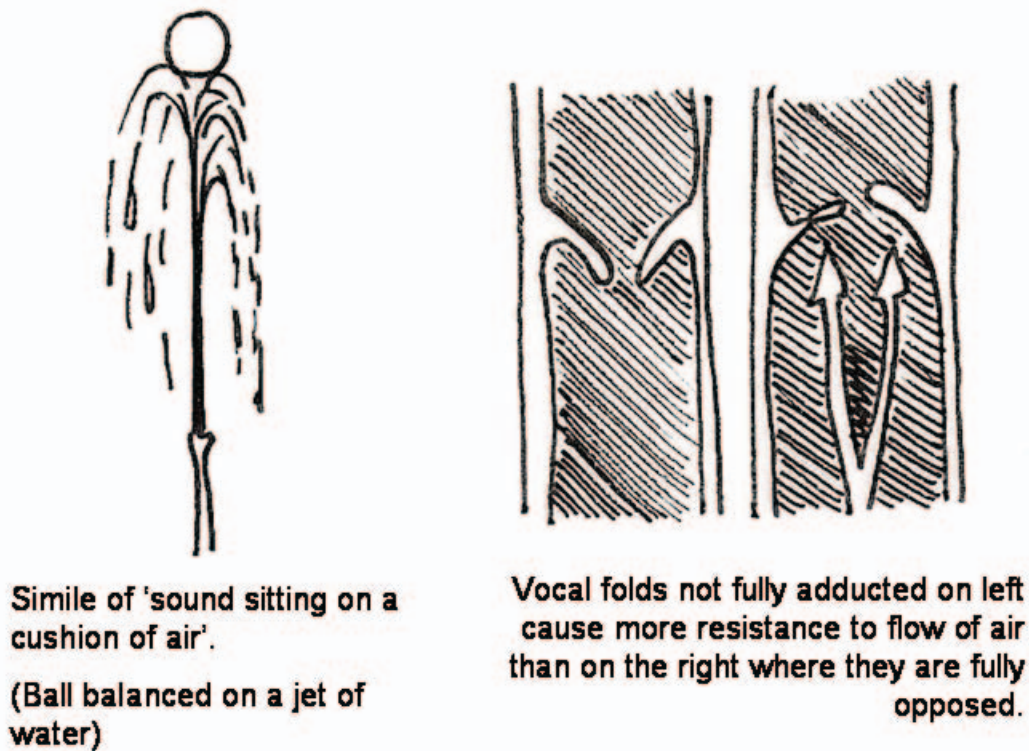


Figure 11 Subglottic pressure

This information should not only benefit singers but flautists as well, since both of these instruments function primarily on breath control. The research does not refer to phonation (something that is absent when the flute is played), but to support and intensity of sound, a direct result of the air stream that is produced (see figure 11). This is something that is equally important in the flautist's and the singer's production of sound.

It is therefore imperative for a flautist to maintain the correct amount of tension in the throat or laryngeal area, since any unnecessary strain would have a direct result on the subglottic pressure, making it impossible to produce a controlled and consistent tone, which is beneficial for the production of vibrato.

2.3.11 Summary

To conclude, for a flautist to be able to produce a natural, even vibrato, it is essential that every part of the breathing organ should be in an exact dynamic balance. Bunch emphasises that the integration of the effort by the muscles involved in the inspiratory and expiratory movement as well as the maintenance of the correct posture will result in the correct type of breathing and therefore the production of vibrato (1982:53).

The author therefore felt it necessary to include an in-depth focus on breathing techniques and the physiology of the abdominal muscles. For flautists to be confident in their breathing technique, it is essential to have an understanding of how their bodies function whilst they are playing or supporting a tone and to be constantly aware of potential faulty habits. It is, after all, the constant re-assessing that ensures the balance necessary to produce a natural tone with vibrato. Any faults will immediately result in an inconsistent tone, an uneven vibrato, a breathy sound quality or simply unnecessary stresses placed on the larynx, shoulders and/or neck.

Once the correct breathing and support methods have been learnt, they will gradually become second nature to a flautist, something that does not require constant control anymore. It is only once there is this certainty of accuracy that the focus can be moved to other elements of flute playing.

According to Bunch, “[a musician] can only develop fully as an artist when the muscular control has become an unconscious reflex and his concentration is devoted to interpretation” (1982:55).

Winckel (quoted in Bunch 1982:55) manages to define the splendour of controlled breathing even more effectively:

Breath is the liaison between excitement of feeling and the physiological effects. The trained singer [and flautist] especially feels this, since he must form the tone on the breath as a

modulating process – and his success – apart from the mastering of the basic technique – is qualitatively dependant upon requirements of the soul.

2.4 Physical aspects of vibrato

The physical aspect of vibrato has been studied since the nineteenth century, with the very first contributions made by Herman L.F. Helmholtz (1877). Although actual vibrato was not discussed, Helmholtz does refer to the physical elements of musical tones of flute or flue pipes in his treatise *The sensations of tone*.

From 1931 to 1940, the researcher Carl E. Seashore³⁰ conducted numerous in-depth studies on vocal and string vibrato from a psychophysical³¹ perspective. The aims of these studies were twofold. He firstly made phonophotographic recordings of musical performance and speech, and then he made psychophysical measurements on the perception of vibrato.

It is from Seashore's studies that we came to realise that vibrato also had a physical aspect and that so-called “good” vibratos needed to be understood from this physical point of view as well. According to Seashore,

An artistic vibrato consists of a periodic oscillation in pitch in which the extent of oscillation for the best singers averages approximately a half-tone and for string instruments approximately a quarter-tone, at an average rate of approximately six or seven cycles per second, and is usually accompanied by synchronous intensity and timbre oscillations which play a secondary role (1931:623).

³⁰ Seashore was a professor in psychology at the University of Iowa.

³¹ *Psychophysics* is the branch of psychology that deals with the relationships between physical stimuli and resulting sensations and mental states.

2.4.1 The three types of vibrato

Seashore was the first to prove what musicians have known all along: there are three different types of vibrato, namely pitch, intensity and timbre vibrato. Physically, a separation can be made between frequency vibrato, amplitude vibrato and spectral envelope vibrato. Perceptually, however, this separation is not audibly noticeable. The different kinds of vibrato generally fuse into one percept. However, experiments suggest that pitch fluctuations have the largest influence on the vibrato percept (Horri & Hata 1988:40; Desain & Windsor 1999:203). Pitch, intensity and timbre vibrato in themselves each vary in terms of extent of oscillation (thereafter referred to as extent; distance between the maximum and minimum value of the sine wave), rate (amount of cycles per second) and form (Seashore 1931:624).

Pitch vibrato

According to Seashore, the average extent of a singer's pitch vibrato is that of roughly a semi-tone. This changes with age and the extent increases as the vocal chords age naturally.

It is common practice for string teachers to advise their students to imitate singers when first learning to play with vibrato to ensure natural development, but the average pitch fluctuation of that of the violin is closer to a quarter-tone than the singer's semi-tone.

The rate of the preferred pitch vibrato ranges from 5 to 7 pulsations per second. The form of the pitch vibrato approximates that of the sine curve.³² Seashore notes that "minor irregularities and tendencies to distort" may occur, but since this will be of no musical significance, they are insignificant enough to exclude (1931:624).

³² Seashore never states why this is important, and does not refer to the shape of the wave form that vibratos approximate again.

Intensity vibrato

The preferred extent of the intensity pulsation is 2.4 decibels and is only about one-fourth as perceptible as the pitch oscillation. Seashore further proved that, as a rule, the intensity and pitch vibrato's fluctuations correlate (1931:624).

Timbre vibrato

By slowing down a phonograph record, Seashore proved that the tone varies in timbre during the crests of both pitch and intensity vibrato. He writes, "It has not yet been possible to formulate any definitive rules for the variation in timbre of the tone" (1931:624).

Currently, however, there are speech recognition programmes that are able to give an exact phonographic reading on the oscillations occurring on every note, and since timbre is formed by the number of audible overtones, these readings could shed light on the exact changes that occur to a vibrato tone's timbre fluctuations.³³

It is important to stress that, due to *sonance* (when successive periodicities of sufficient rate fuse into a unified tone), the three types of vibrato are not registered separately by the listener, but as a singular concept, even when the three are not occurring in unison.³⁴ We are only able to hear about a quarter of what actually occurs when a note is played with vibrato (Seashore 1931:626).

A thorough understanding of the difference between these three types of vibrato is essential when looking at different vibratos from a physical point of view.

³³ The fluctuation in timbre is a direct resultant of pitch vibrato. Every note on the flute consists of a certain amount of overtones. When this pitch is altered, the combination of overtones also varies, resulting in a timbre fluctuation.

³⁴ Seashore found that the intensity and pitch vibrato do not necessarily fluctuate in parallel movement, but since timbre fluctuation is the direct result of pitch vibrato, the last two will occur simultaneously.

2.4.2 Current developments³⁵

With ever expanding technological developments and digital software available to researchers, scientists and musicians alike, the study of the physical characteristics of vibrato has become such a specialised science that it is rarely of practical concern to the average or even professional flautist.

Verfaille et al. (2005) state in the introduction of their article on “Perceptual evaluation of vibrato models” that, of the research being done on the physical elements of vibrato, most

focus on creating a model of amplitude, frequency and spectral envelope modulation, simulating the complex behaviour of the frequencies and amplitudes of harmonics during vibrato. The aim of these models will be to transform the vibrato of traditional instruments in the analysis/synthesis paradigm, and further to generate synthesis vibrato sounds on digital instruments.

Research pertaining to the perceived pitch of a sustained note played with vibrato started in 1980 with Shonle and Horan claiming that this can be estimated by the geometric mean between the extreme frequencies, whilst Järveläinen proved in 2002 that the perception of pitch is independent from vibrato deviation. D’Allesandro and Castellengo (1994) proved that in shorter notes it is the ending of a note that has the biggest influence on the perceived pitch of a note.

Seashore was the first to note that the average rate of a good vibrato is between 5 and 7 pulsations per second. Prame (1997) continued to prove Seashore’s theory and added that these pulsations vary by approximately 8%. Desain et al. (1999) stated that the range of an average vibrato can vary between from 4 and 12 Hz, and that it increases towards the end of a note. Prame then showed that this increase in fluctuation varies at around 15% and Bretos and Sundberg (2003) established that this increase in rate is exponential in soprano singers.

³⁵ All of the information quoted under this heading is as cited in Verfaille et al.’s article “Perceptual evaluation of vibrato models” (2005:2-5). These studies refer to singers and string players.

According to Timmers and Desain (2000), the vibrato extent ranges between 0.6 and 2 semitones for singers and between 0.2 and 0.35 semitones for string players. Bretos and Sundberg (2003) proved that the extent of the vibrato as well as the mean fundamental pitch were correlated with the volume of the sound level. These results led Järveläinen (2002) to conclude that vibrato rate is perceptually more audible than the vibrato extent.

Timmers and Desain (2000) studied the use of vibrato by performers to convey musical expression. Temporal evolution of vibrato was studied by two groups of scientists, namely d'Alessandro and Castellengo (1994) and Desain and Honing (1996). Their focus was predominantly on sustained notes and the transition between notes. They noted that performers anticipate the transition and that these transitions usually occur in phase with the vibrato. Verfaillie et al. explain this movement as follows: “A note ascending towards the following note finishes with an ascending movement in the vibrato, and a note descending towards the following note finishes with a descending movement in vibrato” (2005:2).

Seashore found that vibrato approximates that of the sine wave. Verfaillie refuted this observation, arguing that

The shape of the vibrato has received little attention. Horii (1989) proposed a classification of singer-vibrato-shapes into sinusoidal, triangular, trapezoidal and unidentifiable. But the impact of vibrato shape of perceived sound quality remains to be studied (2005:2).

2.4.3 Analysis of physical characteristics of flute vibrato

In an attempt to further understand the physical characteristic of vibrato, the author recorded various notes, all played with a similar vibrato to that which she would have used in a practical context.

Procedure

The specific notes (g1, g2 and g3) were chosen to represent the three registers of the flute, whilst the b1 and b2 were chosen due to their pedagogical significance.³⁶ The author firstly played these notes (as well as b3) at a *mezzo forte* dynamic to use as a frame of reference with which to compare *piano* and *forte* notes. Secondly, the author played g1, g2, g3, b1 and b2 at a *forte* dynamic, trying to vary both the extent and the frequency of the vibrato rate, followed by the author doing equivalent varieties of these five notes with a *piano* dynamic. The author also played the notes a1, b-flat1, b1, c2, c-sharp2 and d2, aiming to see whether the discrepancies in vibrato shape will only be present in large intervals, or whether these differences will be noticeable between notes varying in only semi-tones. Lastly, the author played the five notes used previously, this time focusing on projecting these notes as if they were being played in a concert hall.

The software *ProTools 7.1* for Apple Macintosh was used to record the author, after which the different notes were extracted as wave (.wav) files. These files were then imported in the speech recognition program *Praat* (also Macintosh software), which enabled the author to extract the pitch contour of each played note. A table of real values could then be extracted, with about 250 (x;y) points, which enabled the author to draw the different pitch contours using Microsoft Excel.

Aim

The main purpose of these recordings was to establish whether there is a noticeable difference in the frequency fluctuation when dynamic variation is also present. Secondly, the intention was to see whether the projected mezzo forte note differs in vibrato shape when compared to a normal mezzo forte note. Thirdly, the author wanted to distinguish what an effect embouchure adjustment has on vibrato at different pitches. It is common pedagogical practice to adjust the embouchure when a *forte* or *piano* dynamic is required to prevent intonation faults. The author wanted to put this to the test to see how large the divergence of intonation would be if the embouchure was not adjusted. Another use of

³⁶ The note b1 is the first note that a flautist learns to play when following the *Altés* method of teaching.

these recordings was to evaluate the frequency and extent of the vibrato when compared to the average values depicted by Seashore.

It is only natural that with the recording of about 60 notes, a few of these will have an irregular vibrato. This resulted in an additional component of vibrato that could be studied, namely the pitch fluctuation of an uneven wave.

According to Verfaillie, "...wind ... instruments ... exhibit more complex vibrato behavior [than singers or string players] combining synchronized variation of not only frequency and amplitude but also spectral envelope" (2005:5).

Although flute vibrato therefore consists of pitch, amplitude and timbre modulation, the author will be referring only to pitch vibrato in both the sketches and the discussion thereof, since this is the most noticeable fluctuation for the listener.

Results for the notes a1 – d2

The first aspect that is clearly noticeable in these pitch contours is that their extent remains constant, while there is a corresponding drop in average (mean) pitch³⁷ towards the end of the notes (evident in figure below).

³⁷ The average or mean pitch is determined by the maximum value (crest) minus the minimum value (trough), divided by two. This value should then either be added to the minimum value, or subtracted from the maximum value.

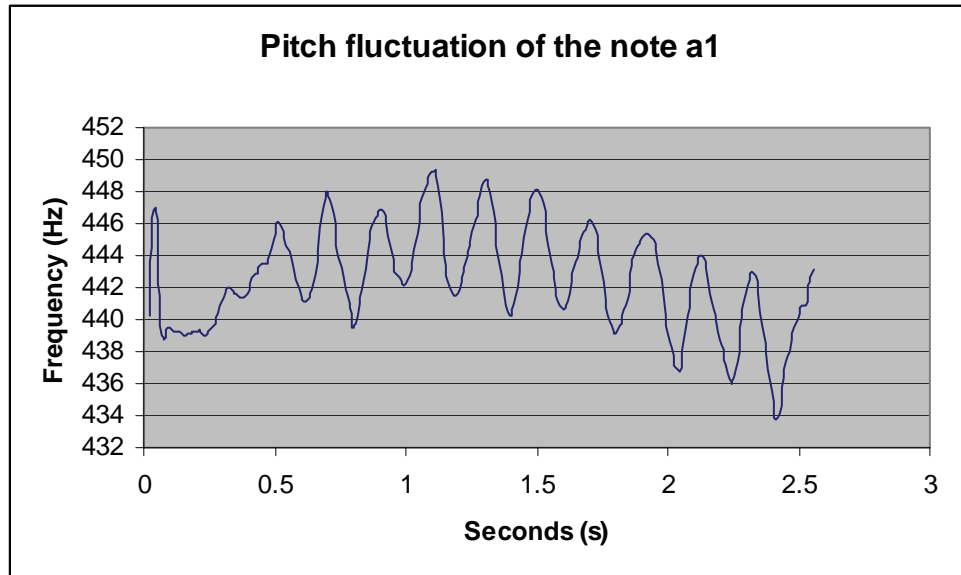


Figure 12

This could be ascribed to the decrease in support towards the end of the note, a common mistake amongst even the most proficient flautists. It must however be noted that this discrepancy would hardly be audible, since the average (mean) pitch at the highest point in the wave would be 445.5 Hz, compared to the mean pitch of 438.5 Hz. Although the note starts as slightly sharp, one must take into account that at this frequency range, a quarter-tone is only 13.1 Hz, and this difference would hardly be audibly detectable. Once again, towards the end of the note, the mean pitch will be perceived as in tune, even though there is a variation of about 1.5 Hz between this a1 (438.5Hz) and an a of 440Hz.

To put this figure in context, this note has an average extent of roughly 8 Hz, smaller than the average quarter tone depicted by Seashore. The pulsation rate approximates three cycles per 0.5 seconds, therefore six cycles per second, which is congruent with the average values established by Seashore.

When comparing the note a1 to that of the b-flat1, it is interesting to see how much more constant the mean pitch values are (see figure below).

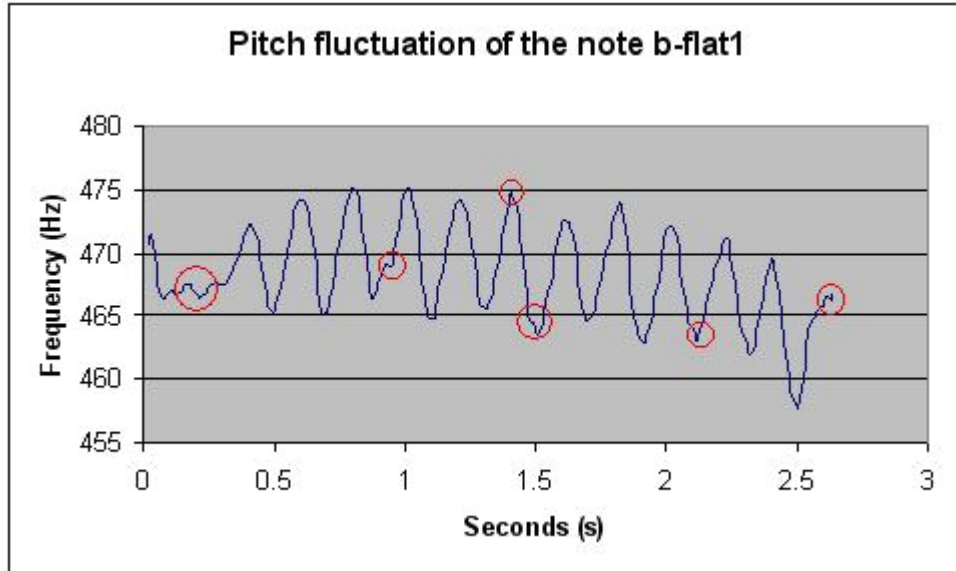


Figure 13

The average extent of b-flat1 is also relatively similar, 10 Hz, compared to the 8.5 Hz found in a1. It is remarkable to note how many irregularities occur within the wave (all marked with red circles in the figure above). This is evident because this fluctuation is the result of the abdominal muscles contracting, something that will not result in a flawless sine wave.

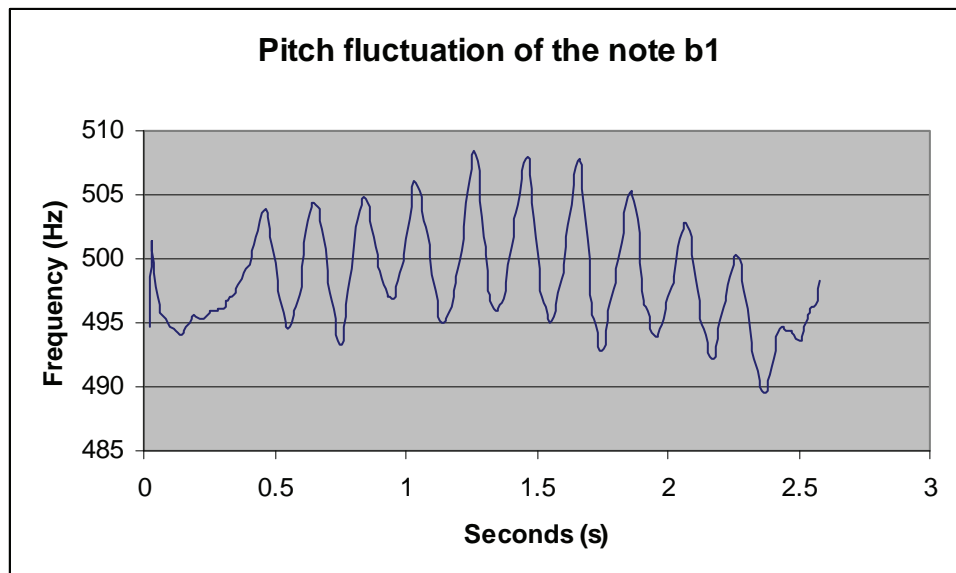


Figure 14

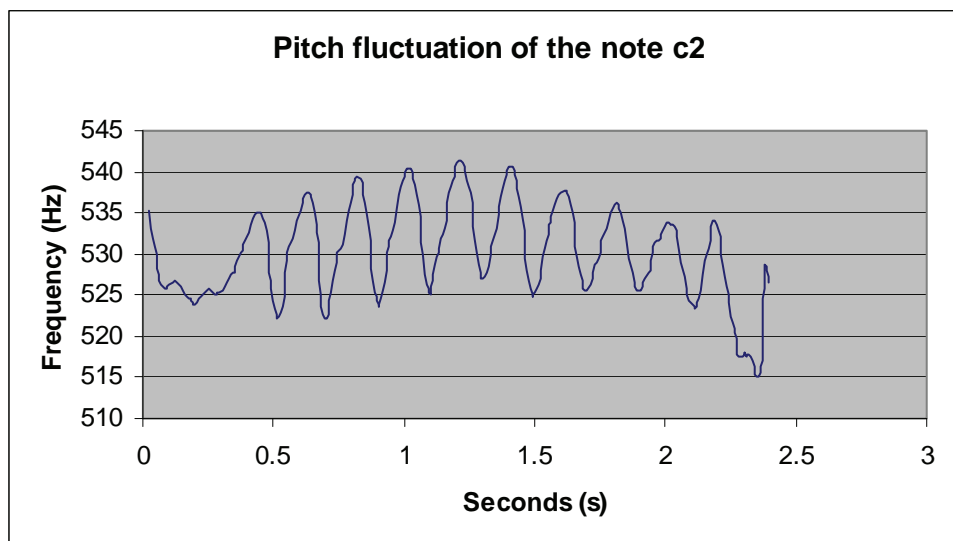


Figure 15

The notes b1 and c2 are relatively similar to the previous two notes (as seen in two figures above). The chart below compares the average extent, frequency and pitch of the six notes as well providing the correct frequency listing of each of these notes.

Notes	Average extent	Fluctuation rate	Actual frequency	Frequency listing ³⁸
a1	8.5 Hz	5.5	442.5 Hz	440 Hz
b-flat1	10 Hz	5	468.3 Hz	466.2 Hz
b1	13 Hz	5	498.4 Hz	493.9 Hz
c2	15.5 Hz	5	530.2 Hz	523.3 Hz
c-sharp2	16 Hz	6	565.3 Hz	554.4 Hz
d2	12 Hz	6	594 Hz	587.3 Hz

³⁸ This refers to the actual Hz value that a note would be if it played perfectly in tune.

The average extents of the notes increase with the pitch. It is, however, important to keep in mind that the frequency values are determined with a logarithmic scale. A semi tone in the first register varies between 26 and 34 Hz, whilst a semi tone in the third register will range from 104.7 Hz to 131.86 Hz.

Furthermore, the frequency of the pitch fluctuations stays relatively similar. Although there would be no audible difference between a note played with six fluctuations compared to that of a note played with five, it is the author's opinion that this increase in frequency is ascribed to the fact that more muscular support is necessary as the pitch rises.

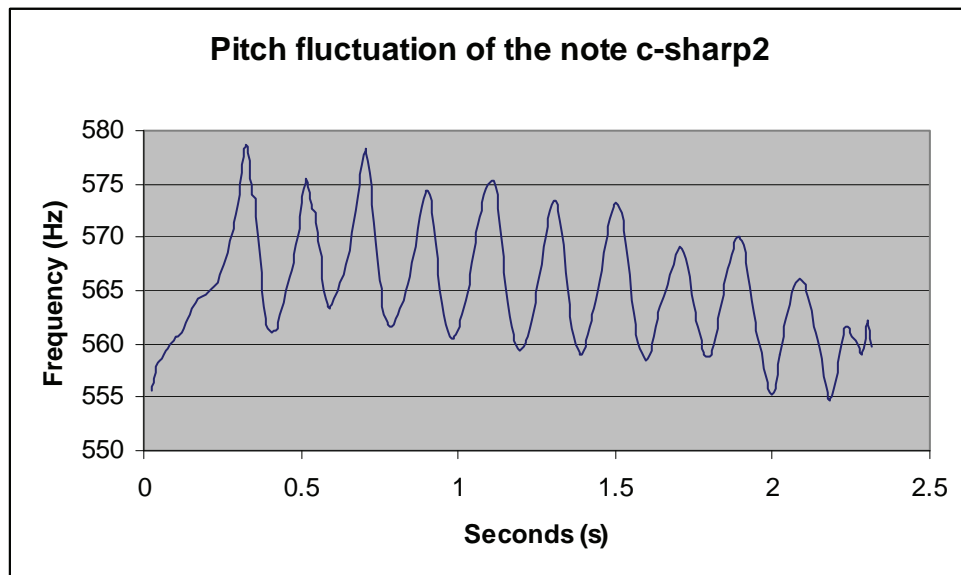


Figure 16

It is common knowledge that the note c-sharp2 has a characteristically dull timbre, which could explain the increase in both frequency and extent (see above).

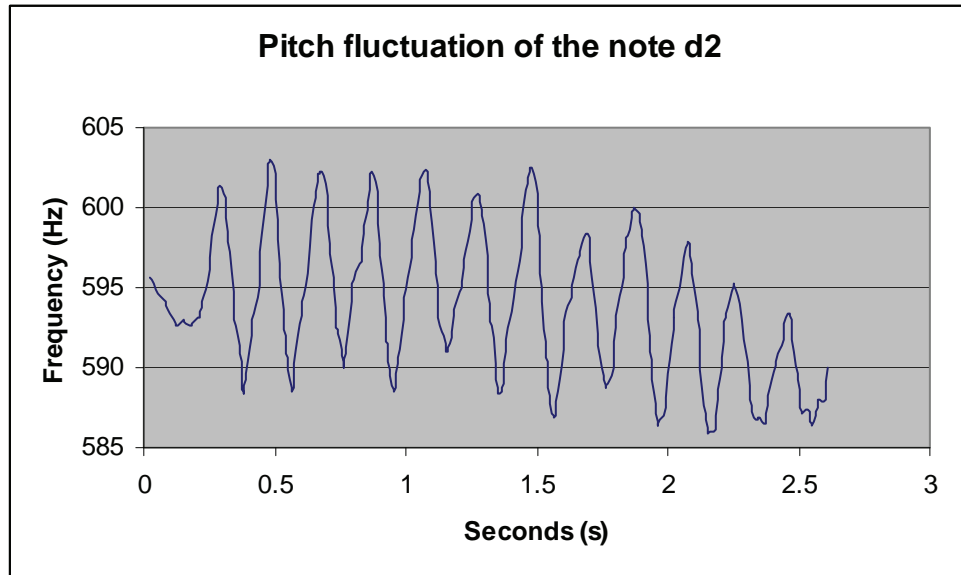


Figure 17

The previous figure tends to be misleading in that it seems as if the extent of this pitch fluctuation has increased greatly. This fluctuation is, however, well within the logarithmic scale of Hz values and it is in fact only a moderate increase when compared to that of the note a1.

Results for the mezzo forte notes

As previously discussed, the mezzo forte notes were mainly recorded to use as frame of reference for the forte and piano notes. Note how the different registers of the flute present themselves in the following graphic representations of the pitch fluctuation involved.

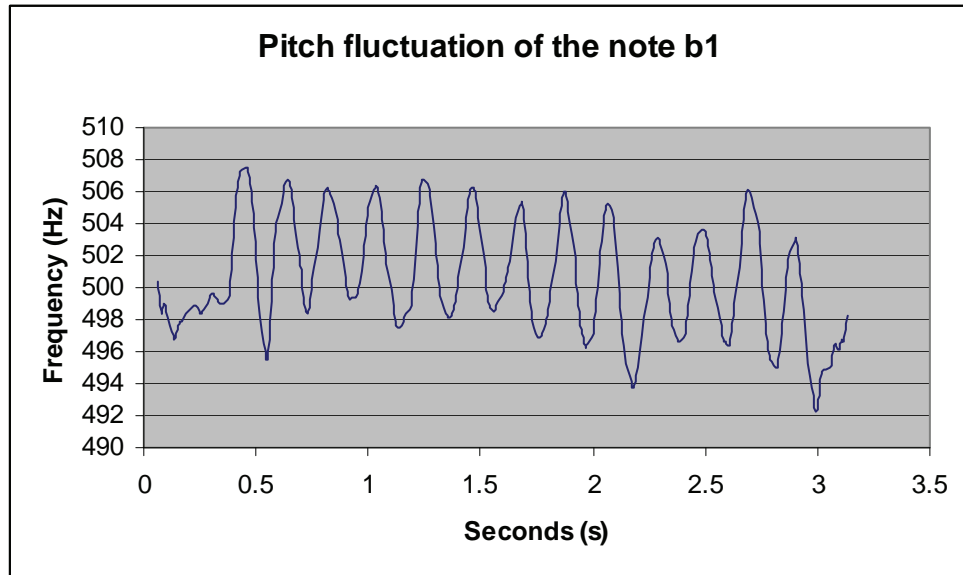


Figure 18

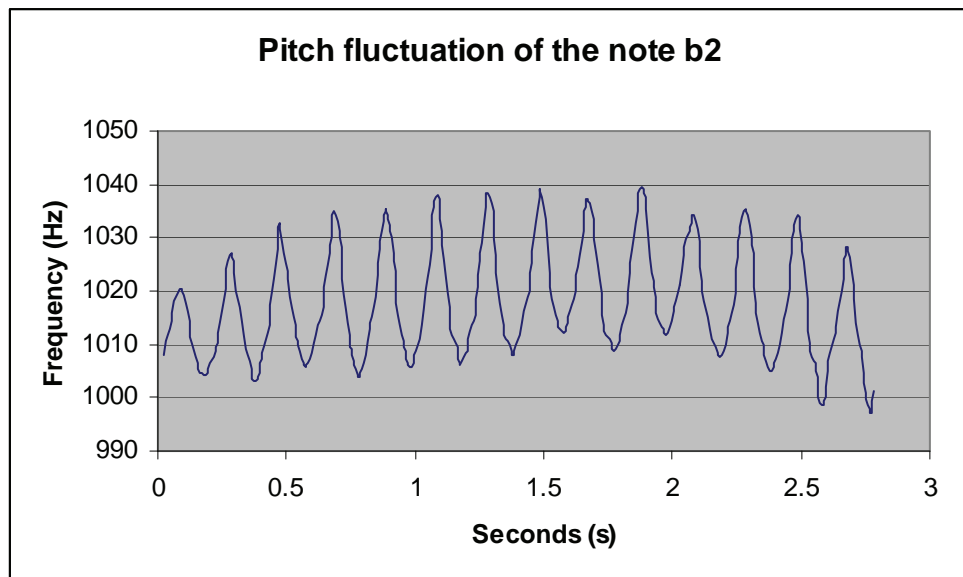


Figure 19

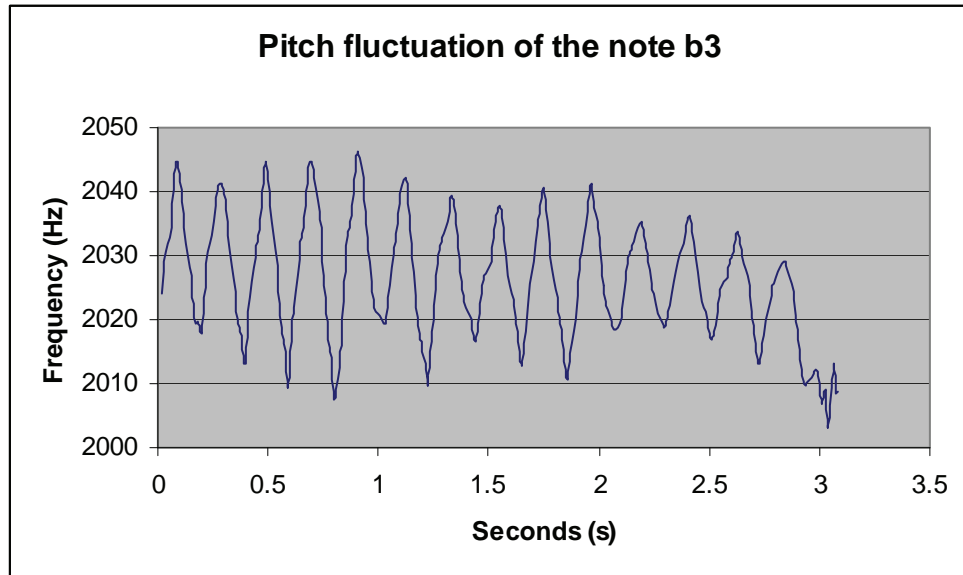


Figure 20

In the next table, the average extent, frequency and pitch are compared, as well as the frequency listing of the notes b1, b2 and b3.

Notes	Average extent	Fluctuation rate	Actual frequency	Frequency listing
b1	8 Hz	4.5	500.5 Hz	508.6 Hz
b2	15 Hz	5	1017.8 Hz	1017.1 Hz
b3	10 Hz	4.5	2026.4 Hz	2034.3 Hz

Although the average fluctuation rate is constant, it should be noted that the average extent of b3 is less than that of b2. It should follow that, as the notes become higher, there will be an increase of muscular support, resulting in an even larger fluctuation rate. The author's opinion is however that the smaller extent of fluctuation is a direct result of the challenging aspect of intonation that comes into play in the third register. The third register is typically sharp, and with this knowledge, the embouchure and support will be adjusted, which would result in a smaller extent. With the b2 however, this factor does not come into play, therefore leaving the flautist with more freedom, in a manner of speaking, to exercise more support and as a result have a wider extent.

For the sake of comparison, a similar set of measurements was taken for the various registers of the note g. The note g3 is seen as a far less tricky note than b3 where intonation is concerned, so it is interesting to see what these results depicted.

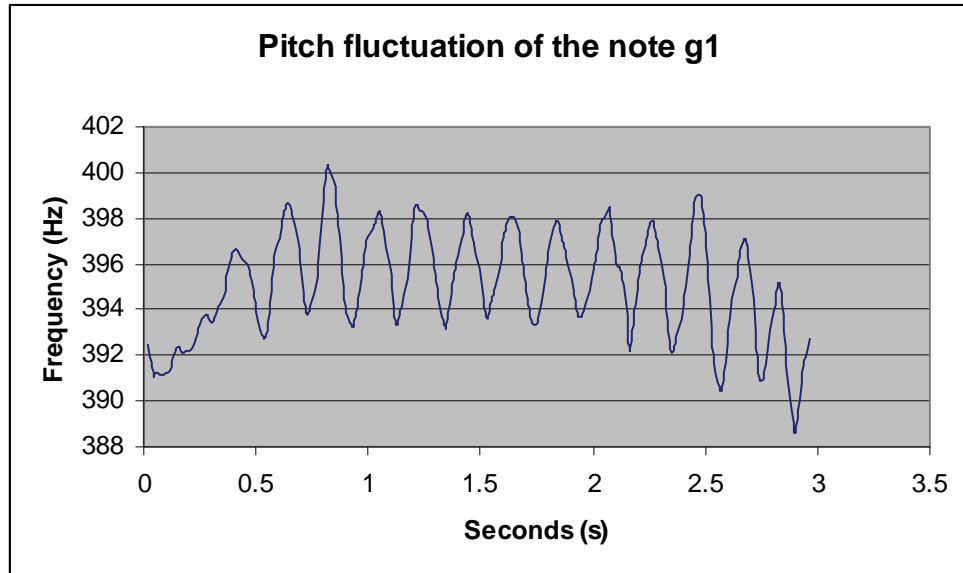


Figure 21

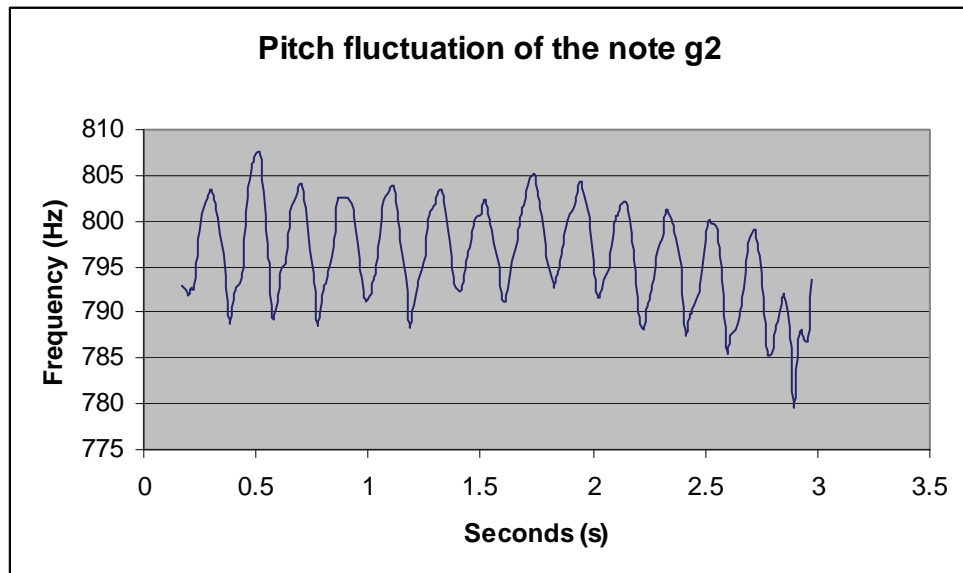


Figure 22

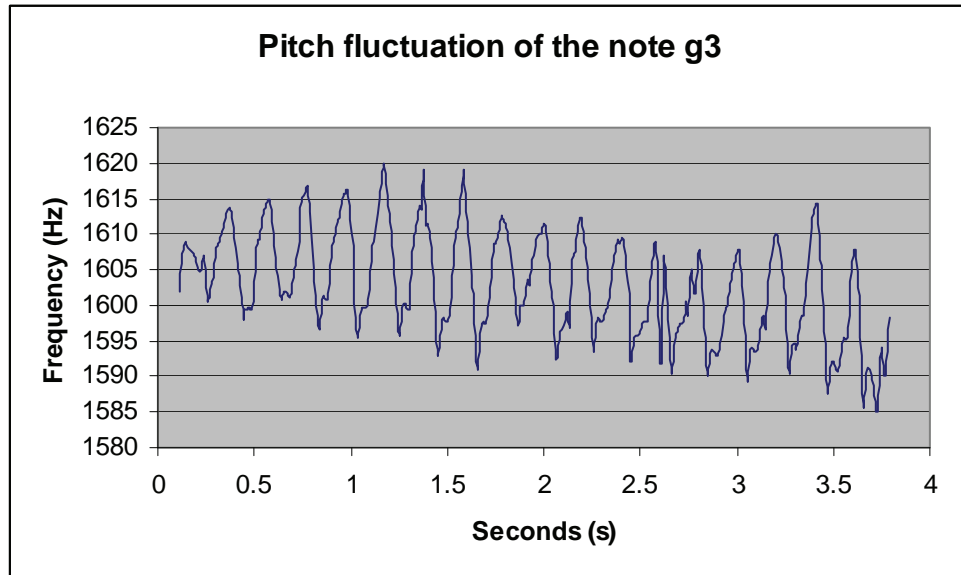


Figure 23

Notes	Average extent	Fluctuation rate	Actual frequency	Frequency listing
g1	5.5 Hz	5.5	395.1 Hz	392 Hz
g2	12.5 Hz	5	796.2 Hz	784 Hz
g3	25 Hz	5	1602 Hz	1568 Hz

The most noticeable feature of g3's pitch contour is most certainly the number of irregularities that occur within the wave. There is a theory that, like a fingerprint or the eye's iris, there are no two vibratos alike. It could be ascribed to mere coincidence, but the fact that these irregularities occur periodically, only in the troughs of the wave, could point to that precise element that results in a unique-sounding vibrato.

Results of the forte notes

It is universally known for notes played with a forte dynamic to be sharp, and the findings of the following graphs were therefore influenced with the adjustment of embouchure. The extent of the vibratos would logically increase when more support is added, whilst the frequency stays relatively constant (between 5 and 5.5 fluctuations per

second). With the note b1 and b2,³⁹ there is a characteristic increase in the extent. The b1's extent is now 13 Hz, whilst the b1 played *mezzo forte* only has an extent of 8 Hz (note figure below).

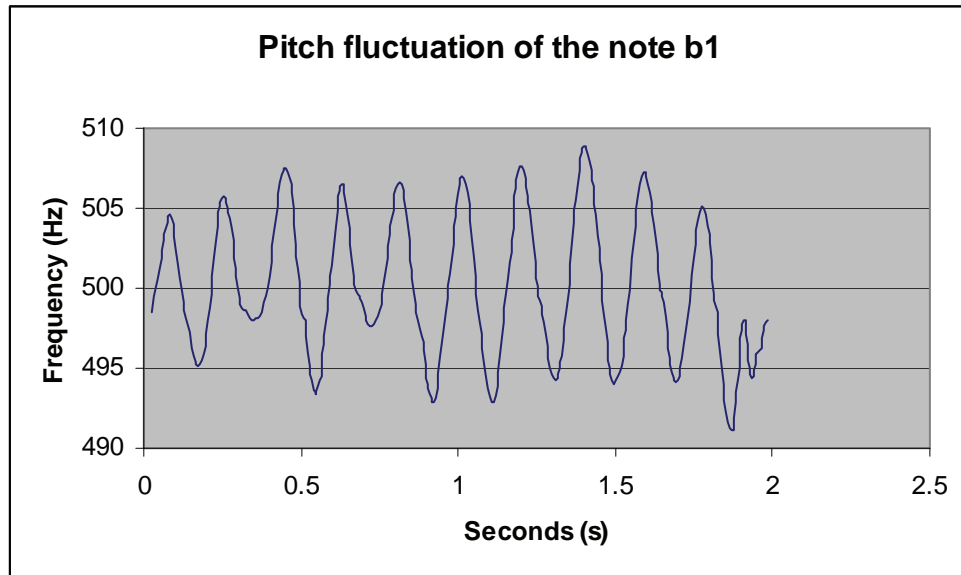


Figure 24

The extent of the b2 is not only larger than that of the octave below (due to increased muscular support), but also larger than that of the same note played *mezzo forte* previously. The extent is now on average 40 Hz whilst the *mezzo forte* b2 was only 15 Hz. The same discrepancies within the wave (at the troughs after 1.5 seconds and 2.5 seconds) as was noticed in the g3 played with a *mezzo forte* dynamic, which supports the theory that this is not a vibrato fault, but rather a factor that contributes to the individual profile of the flautist's vibrato, just as individual as his/her fingerprint.

³⁹ In this exercise, the note b3 is left out because the findings of the actual vibrato shape would be influenced by the fact that this note is characteristically difficult to intonate, and does not appear as frequently in the flute repertoire as the other five notes that were used.

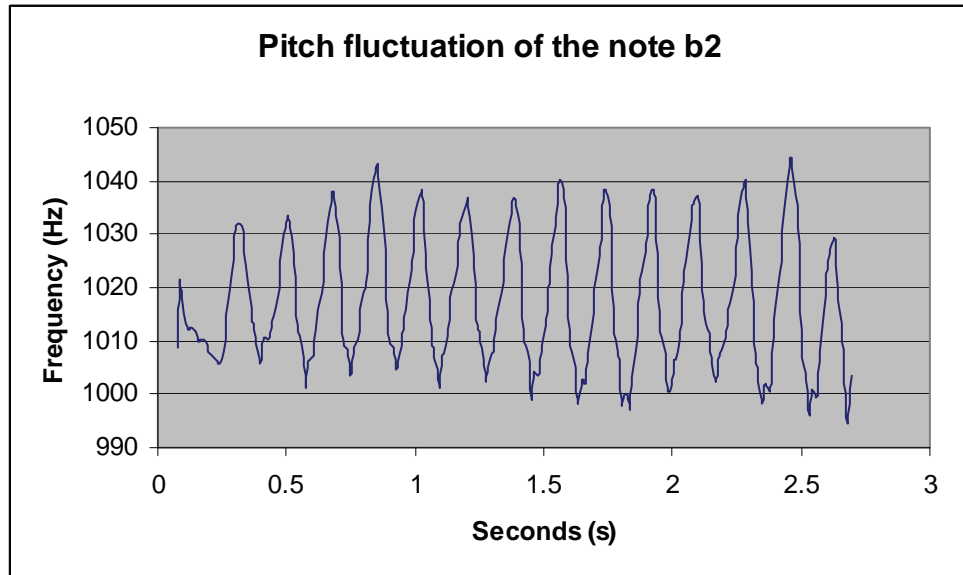


Figure 25

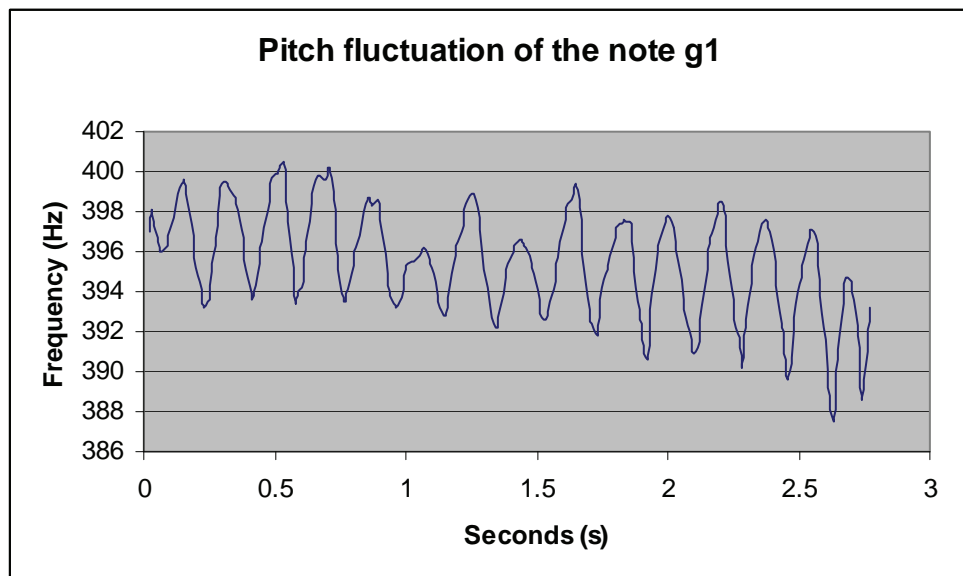


Figure 26

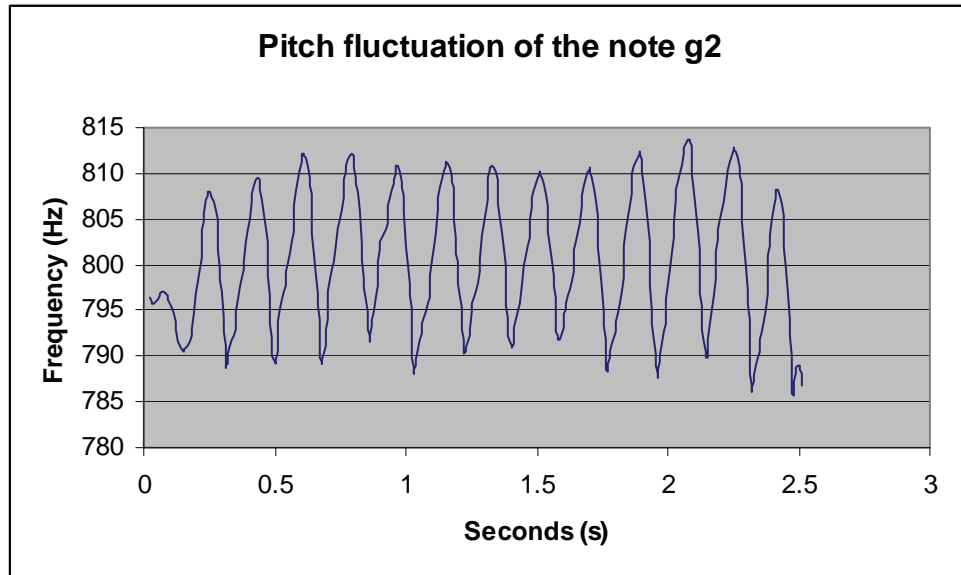


Figure 27

The notes g1 and g2 show consistent characteristics pertaining to the theory that the amount of muscular support has a noticeable effect on the extent of the pitch fluctuation. The extent of g1 is now at 5 Hz (similar to the *mezzo forte* g1), whilst the g2 is now played with an extent of 21 Hz (larger extent, despite the Hz values increasing as the pitch rises), compared to the 12.5 Hz found with the *mezzo forte* g2. The fluctuation rate of these two notes (5.5 fluctuations per second) is also consistent with the fluctuation rate in all of the previously played notes.

The graph below depicts the increase in wave extent when *mezzo forte* notes are compared to *forte* notes, as well as the average extents, frequencies and pitch of each of the five notes. The frequency listings of each of the notes are also added.

Notes	Average extent (<i>forte</i>)	Average extent (<i>mezzo forte</i>)	Fluctuation rate (consistent)	Actual frequency (<i>forte</i>)	Actual frequency (<i>mezzo forte</i>)	Frequency listing
b1	13.5 Hz	8 Hz	5	500.1 Hz	500.5 Hz	508.6 Hz
b2	40 Hz	15 Hz	5.5	1017.8 Hz	1017.8 Hz	1017.1 Hz
g1	5 Hz	5.5 Hz	5.5	395.5 Hz	395.1 Hz	392 Hz
g2	21 Hz	12.5 Hz	5.5	800.9 Hz	796.2 Hz	784 Hz
g3	40 Hz	25 Hz	5	1620.5 Hz	1602 Hz	1568 Hz

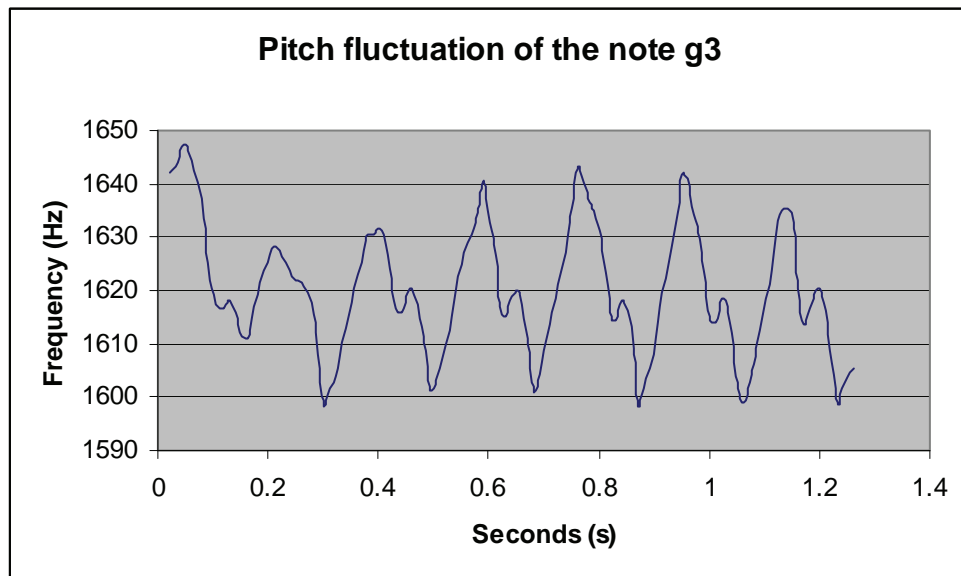


Figure 28

Although the irregularities in the pitch fluctuation of g3 is not consistent with the previous findings (they do not occur at the trough, but in the middle of the wave), it is difficult to understand the appearance of this wave. The fact that this irregularity occurs periodically, however, still proves that this could not possibly be a vibrato fault. Surely a breach in muscular support (which would result in an irregularity like this) would not occur consistently, evenly spaced and only when great support is required?

Results of the piano notes

The table below depicts the average extent, frequency and pitch of each of the *piano* notes, as well as the correct frequency listing.

Notes	Average extent	Average frequency (fluctuations)	Perceived pitch	Frequency listing
b1	6 Hz	5	497.6 Hz	493.9 Hz
b2	13 Hz	5.5	1011.7 Hz	987.8 Hz
g1	7.5 Hz	5.5	394.5 Hz	392 Hz
g2	11 Hz	5	796.5 Hz	784 Hz
g3	24 Hz	5	1606 Hz	1568 Hz

As is expected, the extent of the pitch fluctuation increases as the pitch rises. As with all the other exercises, the frequency stays relatively constant, and there is a general tendency to be sharp. If only a few notes were sharp, this could be construed as a result of the dynamic requirements, but since there is a universal occurrence of every note being sharp, it would seem more logical that the instrument was either tuned slightly higher, or that (as a result of the previous exercises) the instrument is going slightly sharper as the instrument gets warmed up⁴⁰.

⁴⁰ Note that this discrepancy is still less than a quarter tone, which would not necessarily be audible.

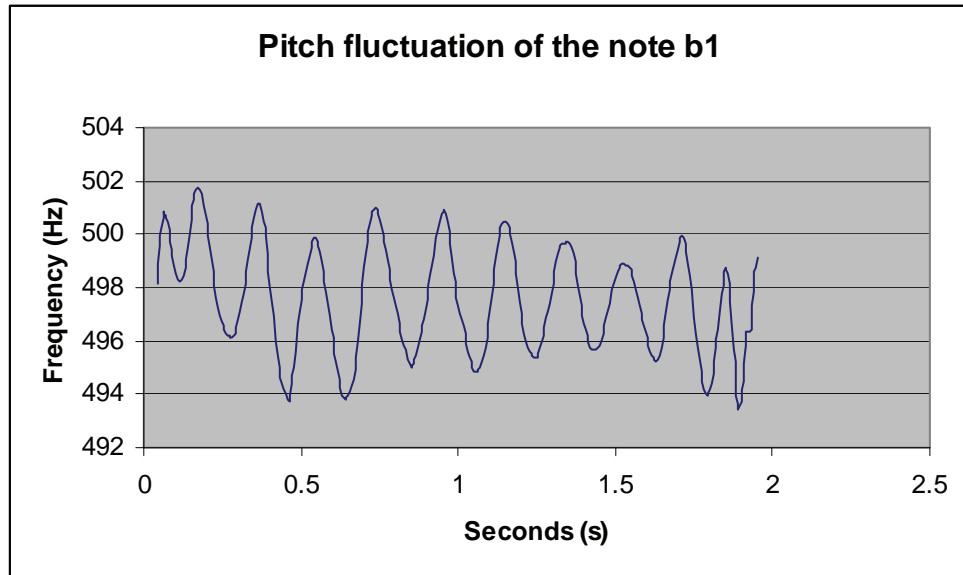


Figure 29

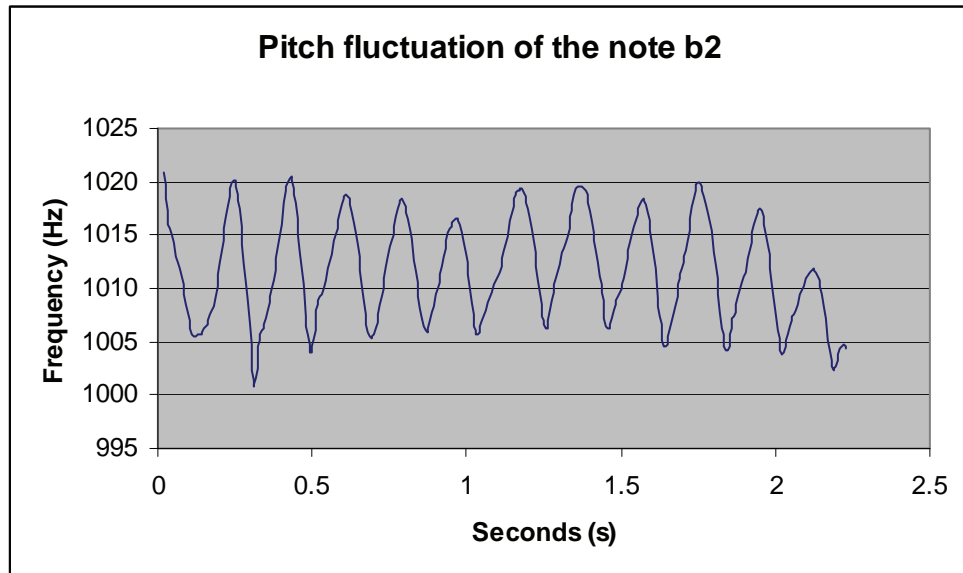


Figure 30

Note that where previously the pitch contour displayed a slight decline towards the end of the notes, the notes played with a *piano* dynamic seem more stable when the average pitch is examined.

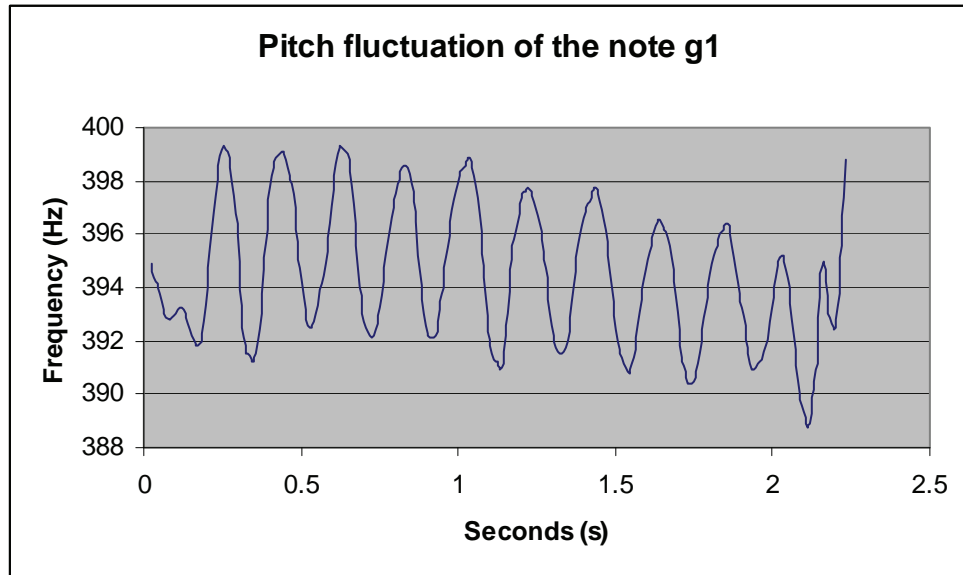


Figure 31

It is thought that the fluctuation of a quarter tone either way is the most ideal pitch fluctuation. Seashore was the first to prove this notion, arguing that “[e]xperiments tend to show that probably the most pleasing vibrato on the average would be that of the violin, namely, a quarter of a tone or slightly less” (1931:625).

The table below depicts the differences in the extent of the piano, mezzo forte and forte notes, as well as what the extent would be if there was an exact fluctuation of a quarter tone above and below each specific note.

Notes	Average extent (piano)	Average extent (mezzo forte)	Average extent (forte)	‘Ideal extent’
b1	6 Hz	8 Hz	13.5 Hz	28.8 Hz
b2	13 Hz	15 Hz	40 Hz	57.1 Hz
g1	7.5 Hz	5.5 Hz	5 Hz	22.7 Hz
g2	11 Hz	12.5 Hz	21 Hz	45.3 Hz
g3	24 Hz	25 Hz	40 Hz	90.6 Hz

As seen above, the extent of the recorded notes never approaches the ideal quarter-tone. From the data, it can however be deduced that the extent of the *piano* notes will be smaller than that of the *mezzo forte* notes, as well as the fact that the extent of the *forte* notes will be greater than that of the *mezzo forte* notes. The only exception to the rule is that of g1. Although at first glance it seems to have a decreasing extent, there would be absolutely no audible difference in these three notes, and these values should be interpreted as a mere inaccuracy. If these notes were to be reproduced by a synthesizer, the values will most likely confirm the before-mentioned deduction.

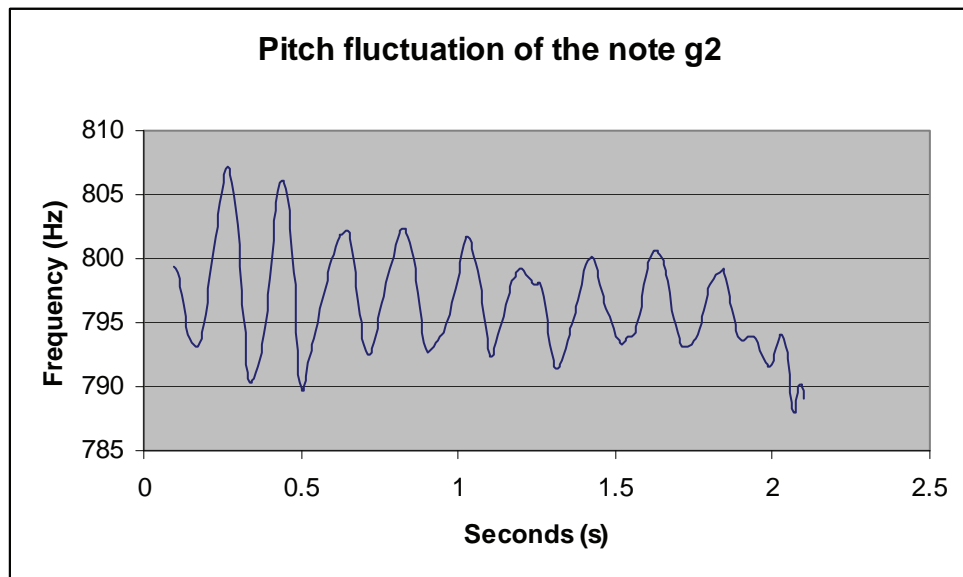


Figure 32

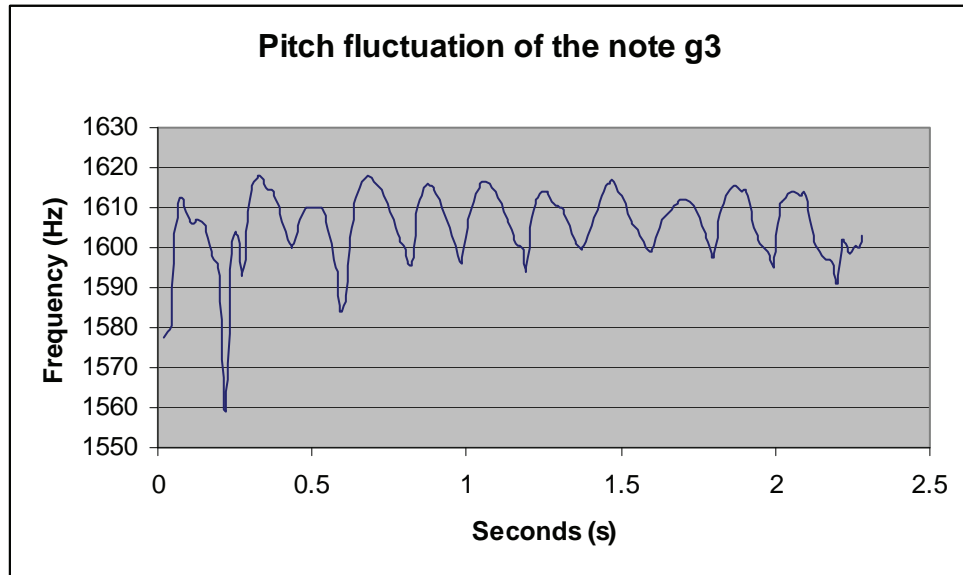


Figure 33

Although the figure above would seem to show that the extent of fluctuation is smaller than for the previous notes, it must be noted that the y-axis now consists of 10 Hz intervals whilst for previous notes it was divided into 2 Hz or 5 Hz intervals, which would create this optical illusion.

Results of the notes played with added projection

Flautists often refer to the term ‘projection’. This term describes the playing of a note that would supposedly ‘carry’ further in a concert hall. The question however arises whether there is a real physical difference between these ‘projected’ notes and notes simply played at a higher dynamic. The aim of recording these notes was therefore to compare the difference between these two subjective approaches.

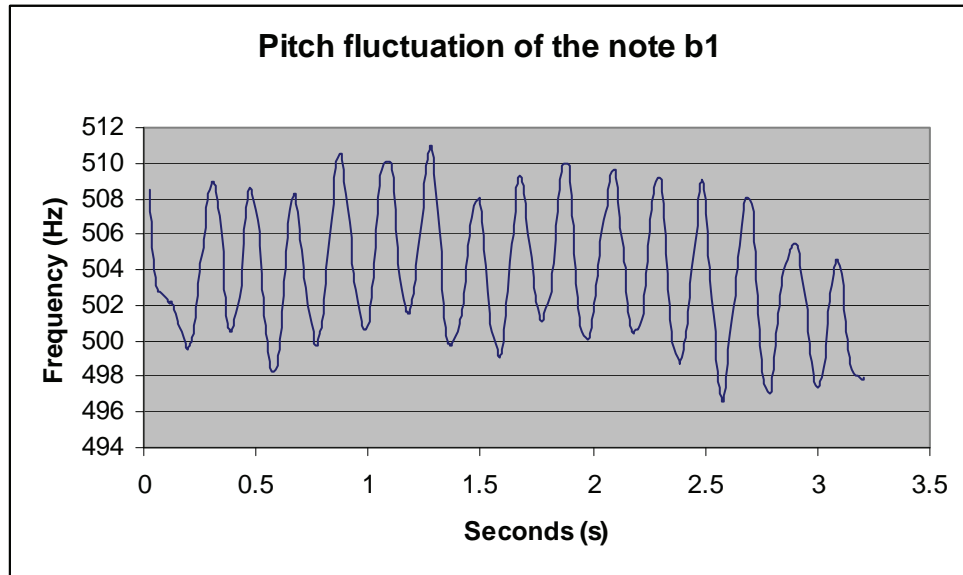


Figure 34

The troughs and crests of these notes (see above and below) are slightly sharper than those of the *mezzo forte* notes, and present characteristics similar to the *forte* notes. These notes were played at a *mezzo forte* dynamic, but appear similar to the *forte* notes due to the added muscular support necessary to play these notes with added projection.

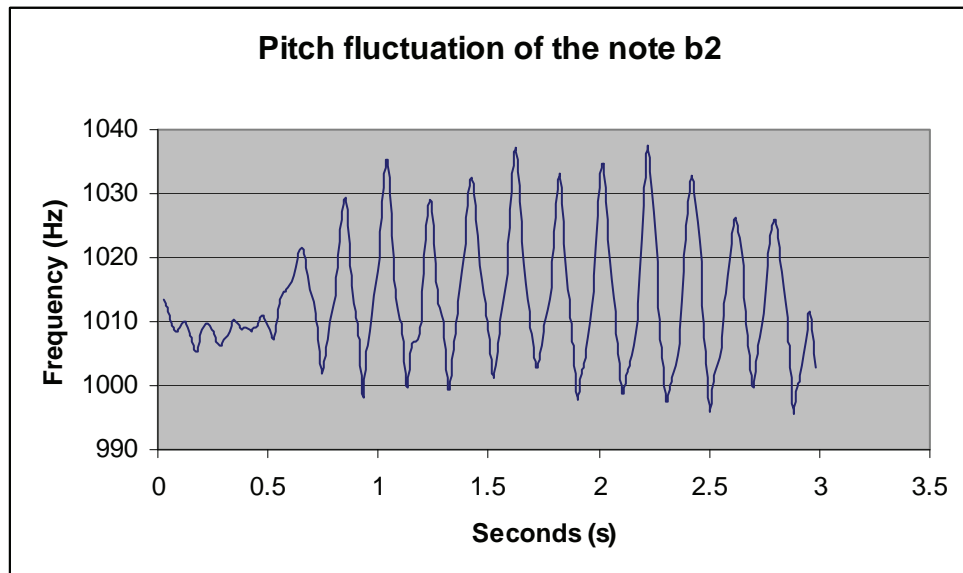


Figure 35

The figure below shows the correlation between a *mezzo forte* b2 played with projection and a b2 played with a *forte* dynamic. There is a significant resemblance in both extent and frequency.

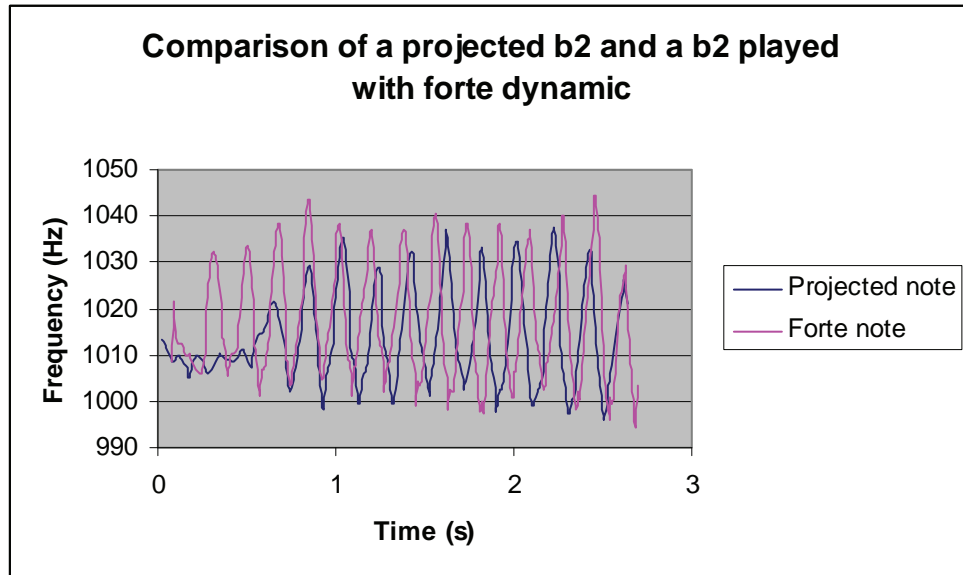


Figure 36

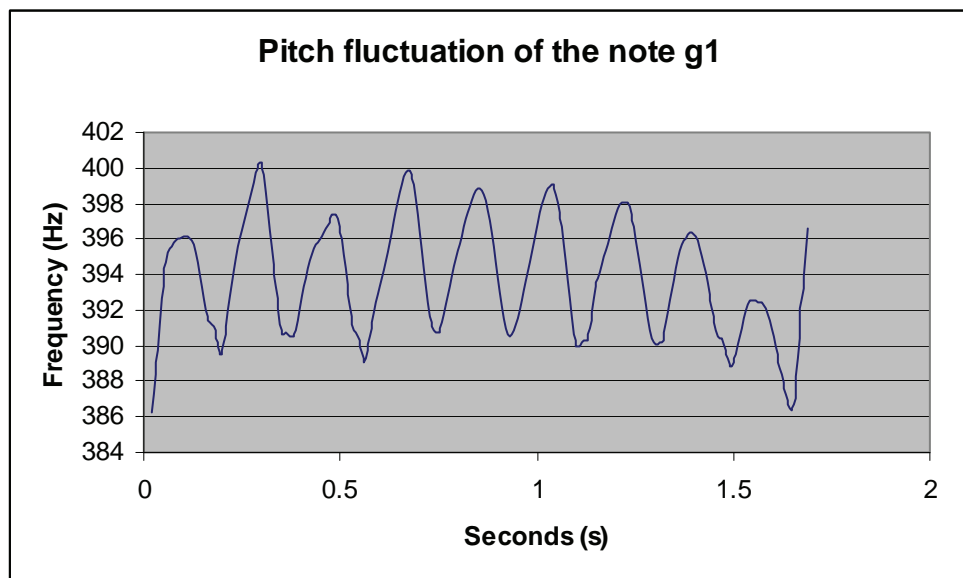


Figure 37

Although the frequency of this pitch modulation seems slower, the x-axis is divided into 2 seconds, compared to the other graphs where the x-axis is up to 3.5 seconds. Note the average extent, frequency and pitch as well as the pitch listings for each of the notes played with projection (below).

Notes	Average extent	Average frequency (fluctuations)	Perceived pitch	Pitch listing
b1	9 Hz	5.5	503.7 Hz	493.9 Hz
b2	35 Hz	5.75	1013.3 Hz	987.8 Hz
g1	9 Hz	5.5	393.8 Hz	392 Hz
g2	16 Hz	5	792.3 Hz	784 Hz
g3	28.5 Hz	5	1601.3 Hz	1568 Hz

In addition, note the correspondence in average extent and perceived pitch of the notes played with projection and the notes played with a *forte* dynamic (below).

Notes	Average extent (projected)	Perceived pitch (projected)	Average extent (forte)	Perceived pitch (forte)
b1	9 Hz	503.7 Hz	13.5 Hz	500.1 Hz
b2	35 Hz	1013.3 Hz	40 Hz	1017.8 Hz
g1	9 Hz	393.8 Hz	5 Hz	395.5 Hz
g2	16 Hz	792.3 Hz	21 Hz	800.9 Hz
g3	28.5 Hz	1601.3 Hz	40 Hz	1620.5 Hz

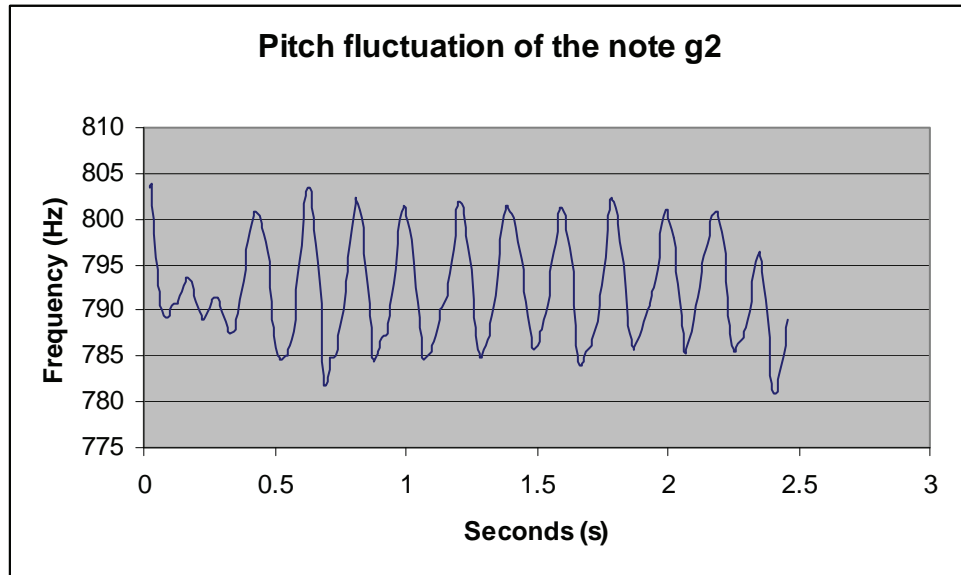


Figure 38

When the note g2 is played with projection (see above), it is once again noticeable how an irregularity is present in the pitch fluctuation (after 1.5 seconds). The irregularity seems to increase and become more evident when the note g3 is played, due to the increase in muscular support required to project this note (below).

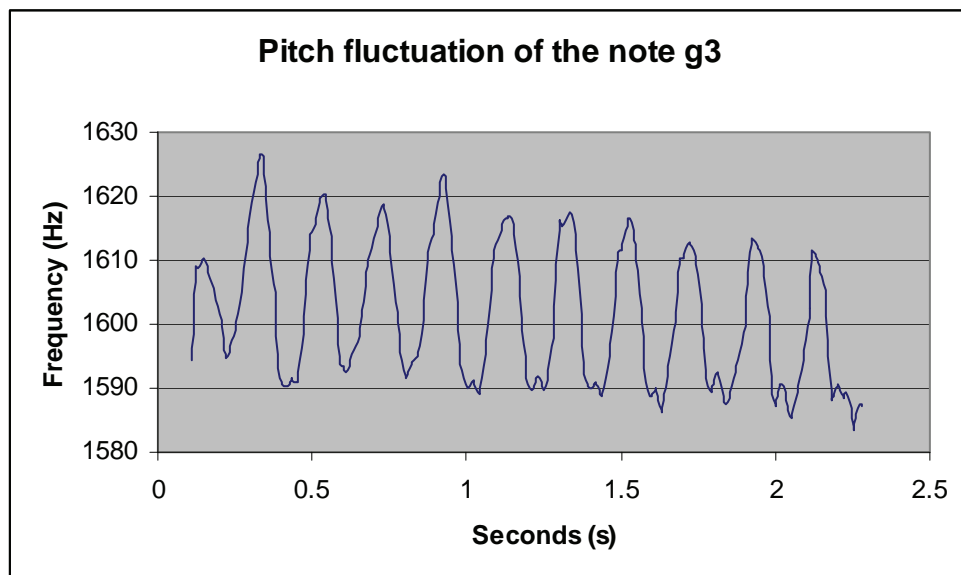


Figure 39

While the need for more muscular support consistently seems to result in this irregularity, it is not audibly perceptible. It is also evident that the increase of support results in a constant average pitch when compared to the slight drop found in the notes played with a mezzo forte dynamic.

Results of the notes played with intonation faults

As already stated, some of the notes with either *forte* or *piano* dynamic were played without adjusting the embouchure to investigate not only the difference in intonation, but also vibrato. In the figure below, a normal b1 is compared to a b1 played with a *piano* dynamic without the embouchure adjustment.

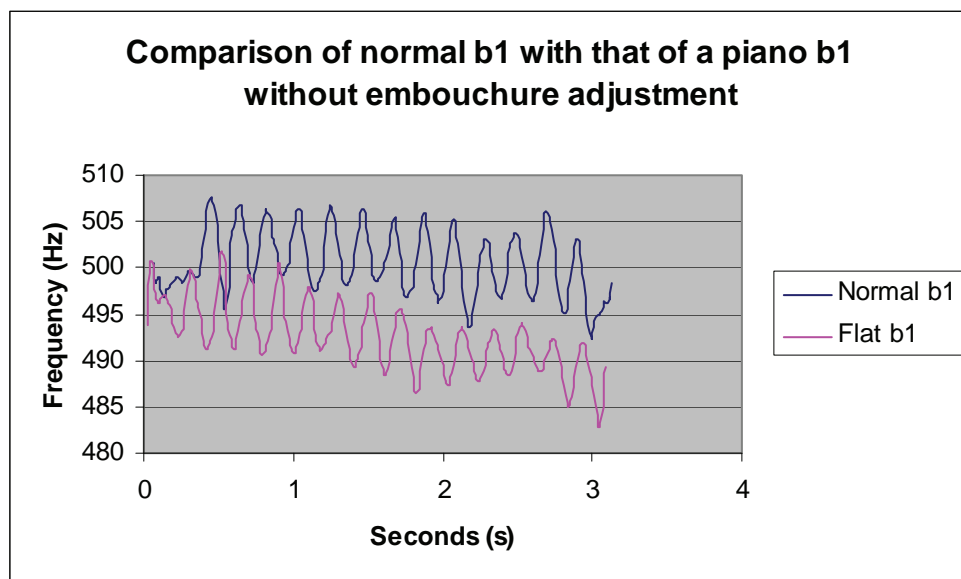


Figure 40

It is clearly visible how the two notes start at relatively the same pitch. As time progresses, the second b2 (with *piano* dynamic) has a decreasing average pitch and results in a perceived pitch of only 492.4 Hz compared to the 504.6 Hz (perceived pitch of the *mezzo forte* b1) it is supposed to be.

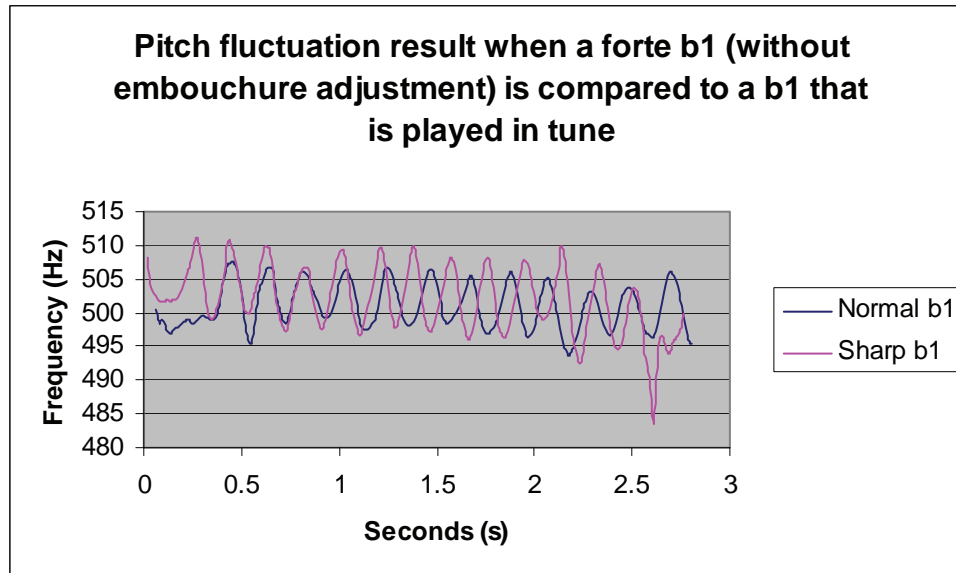


Figure 41

The same rule is applicable to the contrasting scenario (see above). The note b1 is played at a *mezzo forte* dynamic, followed by another b1 played at a *forte* dynamic without the adjustment of the embouchure. Although the increase in average pitch is not as clearly visible as before, there is a noticeable increase in the extent (especially around the crests of the pitch fluctuation) as well as the frequency of the second b1.

Results of the notes played with uneven vibrato

As a result of human error, a few notes presented with an uneven vibrato, both graphically and audibly. This is clearly evident in the figure below.

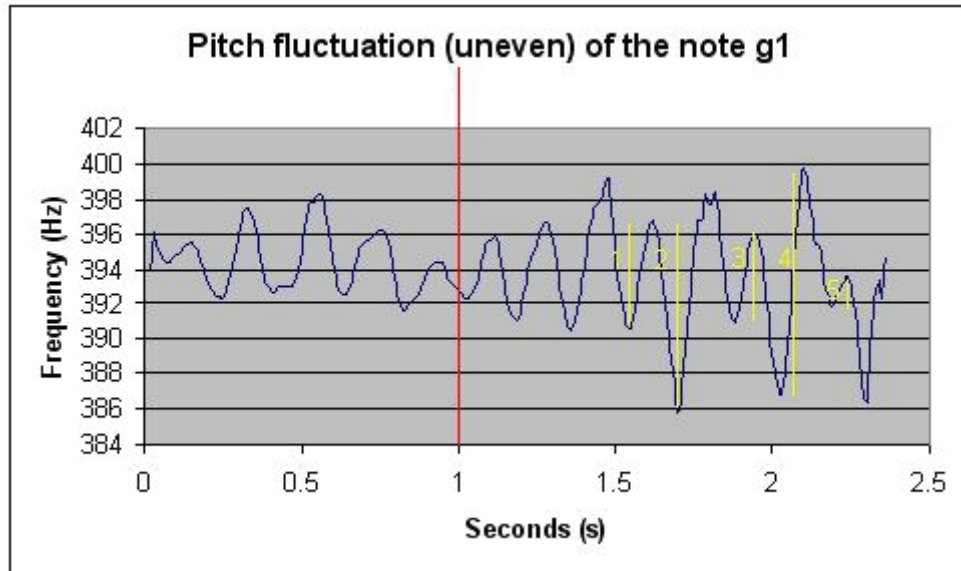


Figure 42

Observe how the average extent of the pitch fluctuation ranges at about 6 Hz before the 1 second mark and then continues to fluctuate irregularly with random extents (marked with the lighter vertical lines and numbers 1 – 5) of 5 Hz, 10 Hz, 5 Hz, 13 Hz and 2 Hz.

Another example of an uneven vibrato is the so-called “hiccup” that is here depicted by the note g3 (see below). At the 1.5 seconds point there is an immediate diminishing in extent for a fraction of a second before the extent returns to normal.

In the notes with audible faults, it is rarely only a fraction of a note that is faulty with the rest of the note returning to normal readings. A good example of this can be seen below where there is the irregularity in the beginning, but also, towards the end, there is a drastic increase in average pitch, inconsistent with the fact that notes tend slightly to fall in pitch towards the end of the note.

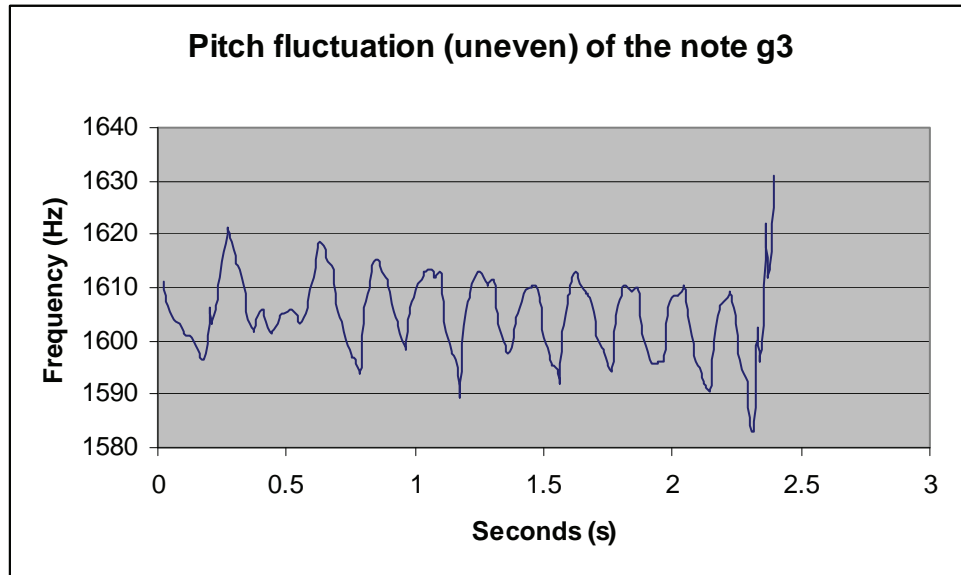


Figure 43

Many reasons may explain why these notes resulted with an uneven vibrato when 95% of the notes played were consistent in terms of average extent and frequency. It is the author's opinion that the reason in this instance is threefold: Firstly, it could be ascribed to incorrect breathing before the note was played. Secondly, it could be a temporary lack of concentration in terms of the muscular support for this note. Lastly, a state of tetany (in other words, too much flexing of the supporting muscles) could result in an unnatural, uneven pulsating air stream.

Other factors that could play a role in inhibiting a natural-sounding vibrato are stage fright, fatigue, stress and medical conditions such as tendonitis, a direct resultant of unnatural strain on the tendons.

Average of minimum and maximum values

The following bar graph depicts the average pitch values of each of the notes played with a dynamic of *mezzo forte*, *forte*, *piano*, added projection as well as the correct pitch listings (see below).

The b1 projected note is the only visible sharper note in comparison to the rest of the b1 notes. The reason for this could be ascribed to the added support without the correct amount of embouchure adjustment. Interestingly, the b2 notes are all sharper than the correct pitch listing, which is due to the second octave being trickier to intonate. Characteristically, the third octave is the most difficult to intonate, which is easily noticeable with the note g3. The notes g1 and g2 are all relatively in tune.

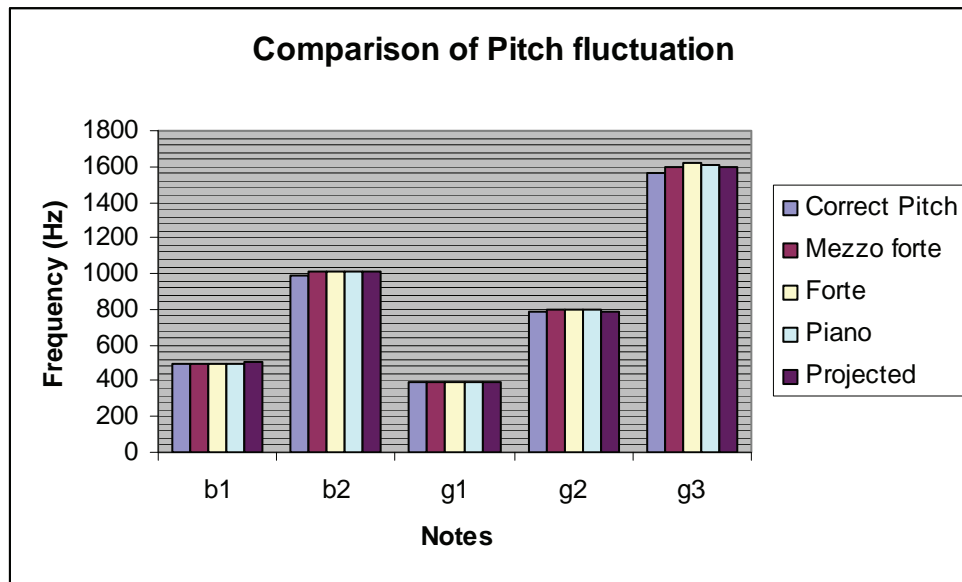


Figure 44

At first glance, the intonation of these notes may not seem as important when the main focus is the study of vibrato. This is not the case. The average pitch is an indication of the entire average of maximum (peaks) and minimum values (troughs) of the actual pitch fluctuation (vibrato), and a vibrato that is not even, too big or too small, would have a direct influence on the average (mean) pitch.

The following graphs show all the minimum values of each of the five notes. As stated before, it is obvious from the graph that the extents of the pitch fluctuations are smaller than that of a quarter tone; therefore resulting in a higher reading (see below).

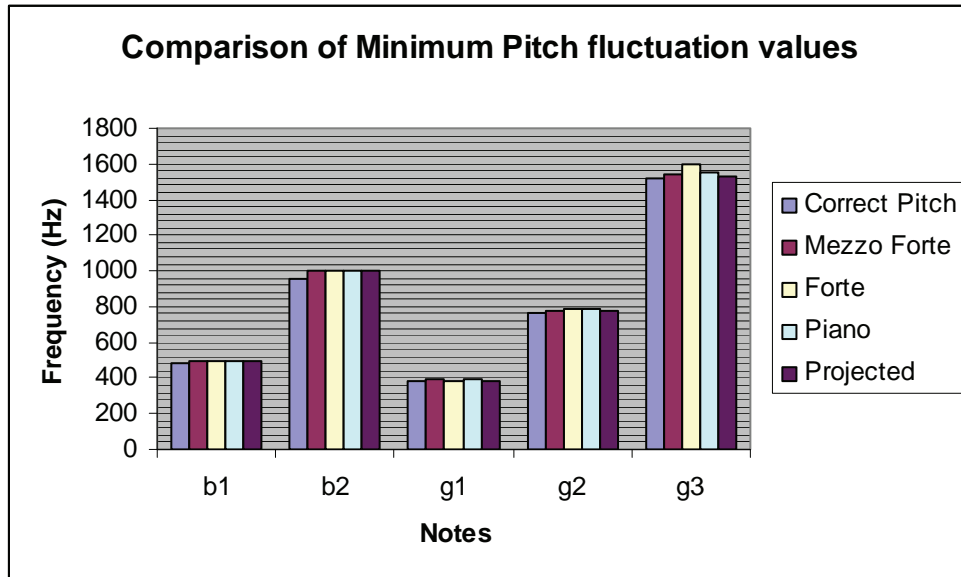


Figure 45

Contrary to what would be expected, the graph shows that the note b2 has an even smaller extent than b1. Although this may seem as if the extent of the actual pitch fluctuation is smaller in the second octave (which should not occur due to the increase of muscular support in the second octave), the average extent of the note b2 depicted earlier clearly shows that there is an increase of wave extent in the second octave. It is also important to compare the minimum pitch value with that of the average pitch value. Since b2's average pitch value is already sharper it is natural for the minimum value to be sharp in comparison to the other values.

The same phenomenon occurs when looking at the g3 played with a *forte* dynamic. Although this note may seem as if it depicts the g3 with the smallest extent, when compared to the average pitch value of the g3 played with a forte dynamic, it is once again shown that the extent of pitch fluctuation increases from the first to the third octave.

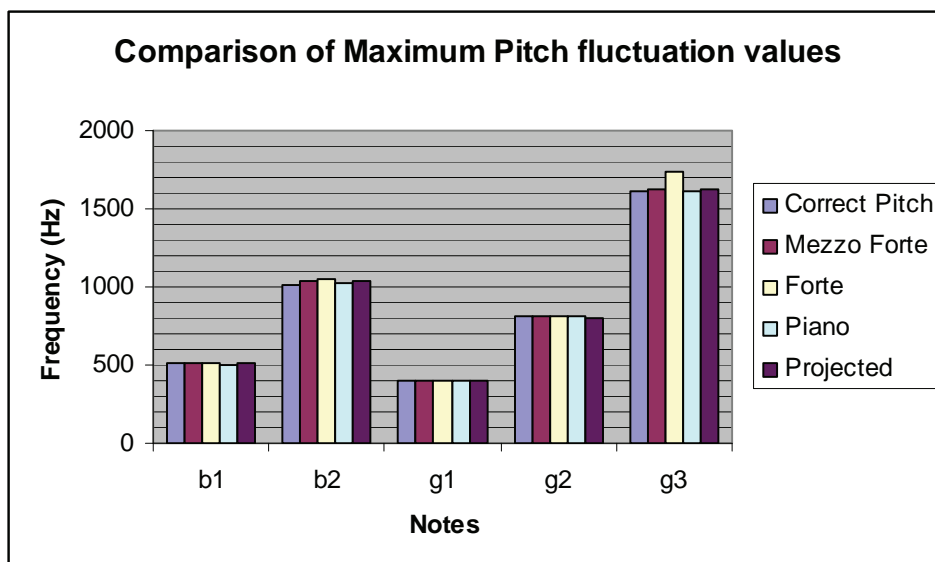


Figure 46

It is evident that the highest notes (b2 and g3) should have the highest maximum values, concurring with the theory that increased muscular support will result in an increased extent and therefore maximum pitch value.

Summary

The first important insight gained from these recordings was that, contrary to popular belief, the frequency of the pitch fluctuation of a note is in no way influenced by the indicated dynamics. The vibrato frequency of all of these notes was consistent in the region of five fluctuations per second, uninfluenced by the varying dynamics required.

The second intention of these experiments was to determine the relationship between the pitch fluctuation extents, the different registers of the flute and the effect of contrasting dynamics. It was evident from the findings that the extents increased from the first register to the third, and that *forte* dynamics consistently resulted in larger extents when compared to notes played with a *piano* dynamic. It can therefore be deduced that a note's pitch fluctuation extent is directly proportional to the amount of muscular control exercised. Since the first octave requires the least amount of support, the extent of the

pitch fluctuation in this octave will be smaller than the extent of pitch fluctuations of the third octave. In the same way, a note played with a *piano* dynamic will always have a lesser extent than that of the same note played at a *forte* dynamic. When a player focuses on projecting a note, the extent of the pitch fluctuation will widen even further.

The extent of the pitch fluctuation is not the only aspect that is influenced by the amount of muscular support. With an increase in support, it was repeatedly found that the troughs and crests of the pitch fluctuation became more angular, resulting in a triangular⁴¹ sinusoidal shape. The slight non-audible irregularities were also found to increase as the support was increased.

Lastly, it was found that notes that did not require as much support usually decrease in pitch towards the end of the note. Although this change in average (mean) pitch was not necessarily detectable, it must be guarded against. The latter phenomenon was not found in notes in the higher register or notes played with a *forte* dynamic.

⁴¹ Horii (1989) proposed a classification of singer-vibrato-shapes into sinusoidal, triangular, trapezoidal and unidentifiable (as cited in Verfaillie et al. 2005).

CHAPTER 3

3.1 A discussion of current vibrato practice with particular reference to different schools of flute playing and influential teachers

Sound ideals of the seventeenth, eighteenth and nineteenth century

It is important to look more closely at the various modern schools of flute playing and in particular at their respective approaches to vibrato in order to understand why certain schools prefer different types of vibrato, timbre and styles of playing.

The flute first entered a so-called golden age in the early eighteenth century. Although it is currently much easier to form an idea of specific national styles of flute playing through the various recordings that are available, it is more difficult to form an accurate impression of national styles of playing before the recording industry gained momentum in the twentieth century. It is nonetheless possible to gain insight into the national styles of playing before the advent of recordings by examining comments by flautists, conductors, music critics and listeners from the eighteenth century.

There were two main influences on the timbre and stylistic approaches used by musicians in the eighteenth century. Firstly, the influence that mother tongue has on articulation is undeniable. Players such as Jean-Pierre Rampal have commented on the similarities of the pronunciation of the French language and the correct embouchure and articulation. (For example, the word *tu* in French meaning “you” is the exact same mouth position as that of the correct articulation of a note.) Secondly, and this is by far the greater influence, is the markedly different flutes used by various nationalities.

The use of vibrato as it is known today only started towards the 1920s. Therefore, although it is important to understand the significance of different instruments and schools of playing before the twentieth century, the discussion regarding pre-twentieth century flute practise will not refer to the use of vibrato as such, but rather to timbre and

sound ideals of the different nationalities. It is the author's opinion that an understanding of basic national styles is crucial when performing pieces dating earlier than the twentieth century. This is congruent with a new awareness amongst flautists and teachers as regards historically informed performance practise. Where music was once performed with the vibrato sound ideal of the time, the era in which a piece was composed now gains more focus. Even though it was only in the twentieth century that vibrato as a variation in timbre and/or sound ideal came into play, the nationality of the composer will still influence the way in which a pre-twentieth century piece should be performed. A French sonata composed by Blavet is now expected to be performed differently to that of a German sonata composed by Bach, because the national style of playing during this time differed so markedly.

Extensive research has been done on the predecessor of the flute as we know it today. Even during the nineteenth century, English, French and German flutes varied greatly in terms of bore size and finger holes. Rockstrow (cited by Wilson 2007) writes,

The bore and finger holes, as made in Germany, were slightly larger than those adopted by France, but both French and German performers generally preferred a small, sweet tone to the powerful and rich one for which the English were celebrated, particularly in the lowest octave.

Solum (1992:65), for example, mentions one of the most celebrated English flautists of the early nineteenth century, Charles Nicholson (1795–1837), who was renowned for his immense sound and bravura style, and who consequently endorsed a flute with an immense sound, made possible by large tone holes, a large embouchure hole and a headpiece lined with metal.

Significantly then, the inspiration for Boehm's modifications to flute design came during a concert tour in England, which received good reviews but left him unsatisfied with his instrument. In a letter to Mr Broadwood, dated August 1871, Boehm (1964:08) wrote:

I did as well as any continental flautist could have done, in London, in 1831, but could not match Nicholson in power of tone, wherefore I set to work to remodel my flute. Had I not heard him, probably the Boehm flute would never have been made.

Up to that point, Boehm had still been playing on an eight-keyed flute. He was so impressed with Nicholson's volume of tone, however, that he incorporated the enormously sized tone holes in his new design. One could therefore argue that Nicholson was the father of the English school of flute playing, especially on account of his big, powerful tone. But this was not the only characteristic that distinguished him from other flautists of that time. A student of Nicholson, W.N. James, noted that his teacher possessed a tone that was not only clear, metallic and brilliant, but that also exhibited an incredible volume (cited in Toff 1996:103).

Toff (1996:103) notes that the English remained partial to the wooden flute well into the twentieth century and that a few British players continue to use wooden instruments today. Since the wooden flute creates a denser, more overtly powerful sound than a silver flute does, it is no surprise that the tone of such nineteenth-century French virtuosi as Tulou and Drouet seemed weak to the English. This is because the bore, embouchure and tone holes of the typical English wooden flute were much larger than on comparable French models.

Toff (1996:103) agrees with the commonly held view that the language of a flautist determined the sound ideal of that nationality. Although this opinion still requires adequate scientific research before it can be stated as fact, it is interesting to note that the English tone ideal corresponds with the vowel sounds of this language. If the pronunciation of the word *flute* or *the flute* in English is compared to that of the French pronunciation of *la Flûte*, it becomes apparent that the embouchure for the English pronunciation is much more relaxed and open. This is beneficial for creating a full, strong sound, but with a tighter embouchure and harder attack being necessary to control the high volumes of air.

The German flautists have made an immense contribution to the development of the flute and flute playing. Theobald Boehm (1794 – 1881) is the founder of the flute we still play on today, and Ernesto Köhler (1849–1907) and Anton Bernhard Fürstenau (1792–1852) are some of the greatest pedagogues of their time (De Lorenzo 1951:63–213).

According to Toff, “German ... traditions are much the same as the English; though the typical sounds tend to be duller and thicker. It is almost entirely *senza vibrato* ... the Boehm flute ... was slow to catch on [and only] achieved acceptance ... in the 20th century” (1996:104).

Most of the established German and Austrian orchestras however excluded the use of the Boehm flute until the late nineteenth and early twentieth century. It was apparently the general feeling that this instrument was too loud and insensitive. As a result, certain German players and makers concentrated on developing the “traditional”, inverse conical-bore flute. However, by the end of World War II, the German-style flute and flute playing had almost completely disappeared. It should lastly be noted that vibrato was also a controversial technique in the German school, with some players strongly in favour of it and others thoroughly opposed to it (Powell 2005).

Flautists in Italy, as well as Italians in the Austro-Hungarian and other central European countries, tended to use Viennese-type flutes, some manufactured in Italy, with an extended lower range throughout the nineteenth century.

The introduction of vibrato in the twentieth century

The French school, with its light, vibrato-laden tone and sensitive shadings, has come to dominate flute playing all over the world since the early twentieth century. There have been numerous discussions about this school of flute playing and there is a range of views on what exactly the name implies. Trevor Wye, for example, has stated that it is “[a] method of playing the flute in the style of the great French Masters of the flute from a period early in this century to the present day” (1993:106).

On the other hand, Marcel Moyse, who is regarded by many as the father of this school, viewed it in a more systematic light. He saw it as “[a]n intelligent method of study which results in a completely satisfying musical performance and always respects the composer’s wishes which he has taken great pains to establish” (Wye 1993:107).

In a discussion and demonstration of French flute playing of the nineteenth and twentieth centuries, William Bennett and Edward Blakeman (Blakeman 2006) defined the French flute school as follows:

An unbroken tradition reaching back to Hotteterre who perfected the baroque flute at the end of the 17th century. After him came Blavet, Rault and Devienne who was the first Professor of Flute at the Paris Conservatoire. The Conservatoire line then continues right down to the most recent professors: Crunelle, Rampal, Marion, Debost, Pierre Yves Artaud and Sophie Cherrie.

William Bennett compares the French flute school to Impressionistic paintings: “With lots of light, shimmering light in the whole thing ... [and a]... tremendous simplification of everything” (Blakeman 2006).

Four points of view emerge about what constitutes the French flute school, namely that it is (a) a style of playing; (b) a method of study; (c) an unbroken line or tradition of people involved in the flute world; or (c) a more abstract notion aligning music with the art movement of Impressionism, with its emphasis on light and colour.

According to Dorgeuille (1983:11),

Over the years, the French Flute School has assumed all the characteristics of myth or legend, and fallen prey to all kinds of mistaken assumptions. Various factors have contributed to this: its distant origins, the absence of recordings before the final years of the 19th century, and the persistent reference to Taffanel’s authority.

However, aspects of the French flute school about which there is a greater degree of certainty are the characteristics of the timbre and vibrato, i.e. the technique thereof. Trevor Wye (1993:108) argues that “a French School of flute playing still flourishes, distinguished by the principles of a beautiful tone, a fantastic articulation, a clean technique, a certain flamboyance in both interpretation and performance.”

Commenting on the qualities of tone that can be attributed to the French school, Toff (1996:100) points out that

The essence of the French style is its tone – silvery, pure, sweet and above all, refined. It is not necessarily a large tone; its carrying power results from quality rather than quantity. Its simple elegance, often described by such metaphors as ‘shimmering silk,’ evokes logical comparisons to the music of Debussy.

The comparison made with Debussy’s music is coherent with what Debussy himself wrote about French music (as cited by Toff): “French music is clearness, elegance, simple and natural declamation. French music wishes first of all to give pleasure” (Toff 1996:101).

Whether these characteristic can be attributed to the French language with its encouragement of rapid articulation and clean tonguing as well as its beautiful, sonorous tones, is difficult to say since the style of the French school has since become a more or less international style of playing.

The French style of flute playing was brought to America when a whole generation of Philippe Gaubert’s students immigrated to America. Georges Barrère and George Laurent became the principal flautists of the New York and Boston Symphony Orchestras respectively. Other flautists who immigrated were André and Daniel Marquarre (Boston and Philadelphia Orchestras) and René Rateau (Chicago Symphony Orchestra). These men brought with them the French tonal ideal learnt at the Paris Conservatoire, which, according to Toff, comprised “[c]oncepts of tonal homogeneity (of which Moyse later

became the standard-bearer), of the famous ‘sensitive’ timbral control and of vibrato” (1996:102).

Besides the example that these men brought in terms of sound ideal, Barrère also brought the platinum flute. He premiered his Haynes platinum flute in 1935. Kincaid followed this example and started performing on a platinum flute. He also used a b-foot which is currently still in more frequent use than in France.

The first truly American style of playing started with the flautist William Kincaid. Interestingly, it was his two French flute teachers (George Barrère and George Laurent at Boston University) who had the biggest influence on the development of his sound and his choice of vibrato (Powell 2002:2). According to Toff (1996:102), Kincaid’s tone

... was rich and robust, with great projection. Sometimes described as virile, it was heavier and darker than the traditional French sound. Like Barrère, Kincaid had a magnificent repertory of tone colours at his disposal, and he was extremely careful but devoted and effective partisan of vibrato.

Marcel Moyse arrived in the USA in 1949, relatively late when compared to the rest of the French immigrant flautists, but he also played a great role in the development of the American flute school. Moyse stated in an interview with *Woodwind Magazine* (cited by Toff 1996:102) that he wanted to develop “an American school of woodwind playing that will challenge the best anywhere in the world.”

Since Kincaid’s contribution towards the development of the American sound ideal, little has changed in terms of tone colouring and the use of vibrato. Kincaid’s successor and student was Julius Baker, who led the new generation of American flautists such as Paula Robison, Jeanne Baxstresser, Jeffrey Khaner, Eugenia Zuckerman, Joshua Smith and Gary Schocker to continue his methods of teaching and further develop the American flute sound. One big difference in the teaching methodology of the American school (compared to the French) is the pedagogical attention that vibrato has received. Toff

states that “[t]he Barrère generation, in contrast, considered it a natural or instinctive technique, to be assimilated, not studied” (1996:102).

In the last twenty years, however, the American school has been the pioneer of developing avant-garde techniques. Flautists such as Robert Cantrick, Robert Dick, Otto Luening and Harvey Sollberger have led this new movement in developing modern techniques, such as buzzing, multiphonics, whistle tones, percussive effects and tongue slaps, amongst other, that have vastly expanded the timbral variety of the modern flute.

As already stated, Toff argues that the English style shares as much correspondence with the English language as the French articulation shares with French pronunciation. Powell agrees with this view and points out that “[a] steady, vibrato-free tone and perfect woodwind blending remained the ideals of English flute-playing until after World War II” (2002).

Trevor Wye (as cited by Toff 1996:103) describes this traditional English sound as “[a] typical English weather forecast: Heavy rain with occasional showers and thick fog with mist patches.”

According to Toff, the two main figure heads of the older English sound were Robert Murchie (1884–1949) and Eli Hudson (1877–1919). The English were not immune to the vast influence that the French school of playing was having on America. This influence has been bolstered by the modern breed of French virtuosi – with chief representatives being Louis Fleury (1878–1926), Phillippe Gaubert (1879–1941) and René le Roy (born 1898) – who toured England in the early twentieth century (Toff 1996:103).

At this time of concert tours to England by French flautists, Geoffrey Gilbert, principal of the London Philharmonic at the time, started to make the drastic move of changing his style of playing at a late stage in his career. He began studying with René le Roy, who converted him to the French style of playing, namely the “light, front-of-the-mouth articulation and the French concepts of tonal colouring” (Toff 1996:103). This acted as a

further reinforcement of the influence of the French school in England. Gilbert's own famous pupil of the next generation, James Galway, went to Paris for further instruction from Crunelle, Rampal and Moyse. Other famous British flautists who continued this fusion of English/French playing were Trevor Wye and William Bennett (both students of Gilbert who continued to study with Moyse and Rampal).

The French style of playing also infiltrated Switzerland when their leading flautist, Auréle Nicolet, received tuition from André Jaunet and Marcel Moyse. Nicolet continued to teach Peter-Lukas Graff and Emmanuel Pahud (who also received lessons from Michel Debost, Alain Marion, Pierre Yves Artaud and Christian Larde, currently Berlin Philharmonic's principal flautist).

Since the Germans were the most reluctant to adopt the use of the modern flute and therefore also vibrato, Gilbert (cited by Toff 1996:104) described the sound of the Berlin Philharmonic as having "[s]moothness, but lack of warmth in the woodwinds".

Toff argues that the German sound ideal can be compared to that of the Russian and Eastern European traditions, and describes the sound as being typically duller and thicker and almost entirely *senza* vibrato (1996:104).

In contrast, the Italian school of playing, according to Powell (2002), has a "brilliant technique ... accompanied by a fast, light vibrato." The role of the Italian flautist Severino Gazzeloni in twentieth-century music is undeniable. Although very little information can be found on the quality of his sound or use of vibrato, his technique was so impressive that it inspired composers such as Boulez, Berio and Stravinsky to write orchestral solos and solo works for him to perform.

Italian virtuoso flautist can still be heard when listening to recordings of flautists such as Alligro Tassinari (principal of *La Scala* Opera House, under the baton of Toscanini) and Raffaele Trevisani. Trevisani, one of the few pupils of James Galway, states

I have known Raffaele Trevisani over a period of years and do not hesitate to say that he belongs to the best of the flautist of the day. His perfect technique, beautiful singing tone and dedication to the art of music will ensure him a place of honor with the public and his colleagues (Galway 2007).

The mixing of these styles into a new international style of playing has been ascribed to many factors. Firstly, the recording industry has been a major contributing factor in that we are hearing flautists from all over the world. This enables modern flautists to form a new tonal ideal, comprised of many different styles of playing. Secondly, the fact that teachers have been immigrating and travelling to teach and perform has resulted in a loss of national identity and a school of flute playing that is instead dependant on the teacher. The modern flautist's sound (and use of vibrato) is consequently a result of his or her teacher's tonal ideals rather than his or her country of origin.

Toff (1996:104) describes this new “modern” sound ideal as follows:

Today, as the result of decades of international cultural exchange, the basic concepts of flute playing are consistent worldwide. Yet each true virtuoso has his or her own individual style, which may or may not conform to what were once exclusively national characteristics.

3.2 Vibrato as an expressive device

The degree to which these tools [of expression] can be applied and balanced is infinite and the way you explore and utilize them is how you discover your own musical voice. Assuming a faithful execution of the composer's notation, you can bring out the unmarked objective elements of the music through your own subjective decisions – decisions on how to balance and apply a diverse array of un-notated phrasing devices. Combined with copious amounts of that unquantifiable yet all-important ingredient we call ‘soul’ or ‘spirit’ and you may find that you not only have much more to say with any given piece of music, but so many more ways of saying it than you originally thought possible (Amis 2005).

The term expression has always been a highly controversial topic due to the amount of subjectivity that comes into play when this term is discussed. Although there is a

consensus amongst teachers and flautists alike that, without expression, music will be lifeless and dull, the exact definition of what the term expression entails has not been clearly defined in any of the texts that the author has studied.

The first cause for this confusion may have been the interchangeable use of the word expression and vibrato within the French school of teaching. Moyse was one of the first to say that he played something expressively, rather than admitting to playing with vibrato. Recordings of this master, however, show a definite fluctuation in pitch and intensity, something referred to as a “shimmer” by his students. The confusion between these two terms has continued until the present day. Peter Lloyd (cited by Krantz 2005) admits that expression consists of numerous parts, of which vibrato is only one, but still insists that these two terms should be used interchangeably. Gilbert (cited by Krantz 2005) states that the term expression “more accurately describes the total content of the sound, including volume and tone colour, in which one’s vibrato becomes part of the sound, not something one does to the sound.”

This not only shows a lack of understanding, but also a lack of reflection on what the term expression really encompasses. The term expression deals with much more than the mere quality of a flautist’s sound. It consists of many components, of which the shaping of phrases, volume, dynamics and timbre are but a few. The term timbre will then include the use of vibrato, whether it is to intensify a certain note or phrase, to create the sense of a crescendo or decrescendo, to add a sense of motion or to project certain parts of a phrase.

Toff (1996:113) dedicates a whole chapter to vibrato, in which she states:

The uses of vibrato are so many. It can give warmth or beauty to the tone, a gilt edge or shimmer on the surface of the sound. It can intensify expression by lending emphasis to particular notes (the sense in which it is an ornament). Used selectively within phrase structure, it can enhance the feeling of motion. It can help to project the tone by adding intensity. The best use of vibrato is as a means of varying timbre.

Besides varying the timbre, vibrato also reflects the inner state of the flautist. Whether this be conveying an emotion such as agitation or contentment, or a sense of being lyrical or playing more rhythmically.

As already discussed, vibrato as used today is somewhat of a constant in the modern flautist's tone. Flautists should therefore guard against playing it monotonously. The variation of vibrato is an imperative expressive tool. Amis (2005), for example, argues that "[i]dentifying places within a phrase where a subtle change to a complimentary sound colour can highlight and supplement similar changes in the notation is the sign of a mature artist."

Varying the vibrato is one of the most successful ways of creating variation in timbre, which in turn is not only one of the most effective expressive devices available to a flautist, but also aids in avoiding monotony. Some of the most intensely expressive passages can even be played without any vibrato, creating an entirely new tonal character.

Musical mood

Analyzing a phrase objectively and then consciously utilizing multiple performance tools will not only offer admirable qualities of an interpretation to those who may criticize its more subjective elements but also maximizes your ability to connect with a diverse audience... these *hidden* moments – hidden because they are not made obvious to the performer by the composer's dynamic, articulation or text markings – represent opportunities for profound musical expression (Amis 2005:page).

It is common practice for a flautist to play a lyrical piece with a certain type of vibrato, compared to a more rhythmical piece played with another. It is however a common fault amongst players to neglect variation of vibrato within one specific work.

James Galway (cited by Krantz 2005) states that “[s]ome people think vibrato should have a regular speed. Others clearly demonstrate that it should not. Just as life changes, musical moods change, and variation of vibrato is a large part of the expressive capacity.”

Britton Johnson’s view concerning stylistic approach and interpretation of musical moods, quoted below, is representative of the opinion of many musicians.

Many flautists are great technicians but fail miserably when it comes to interpretation and bringing out character. One of the problems today is that many teachers demand technical perfection but neglect the musical aspects ... the music lacks vitality and is played with little understanding (cited in Jenkins 1986:4).

The importance of a warm and natural sounding tone has already been discussed. This tone is not the only timbre available on the flautist’s palette. Maria Callas held a similar belief. Although a singer’s opinion on timbre may seem negligible due to the differences in these two instruments, it is the collective concept of musicianship that is of importance when expression and tone colour is concerned.

It is not enough to have a beautiful voice. What does that mean? When you interpret a role, you have a thousand colours to portray – happiness, joy, sorrow, fear ... How can you do this with only a beautiful voice? Even if you sing harshly sometimes, as I have frequently done, it is a necessity of expression. You have to do it, even if people will not understand. But in the long run they will, because you must persuade them of what you are doing (cited in Fuchs 2003).

It is this variation in timbre that will enable a flautist to play expressively and to use the type of vibrato that should be dependant on what a specific piece requires in terms of style and mood.

Alain Marion talks about his experiences whilst playing with the Ensemble *Intercontemporain* of the avant-garde composer Pierre Boulez: “During this time I learned how important it is to have a stylistic approach to the music to correctly communicate the composer’s intent” (Goll-Wilson 1987:4).

When asked about the concept of musical mood, he stressed the use of different tone colours to express different moods: “You don’t wear the same shirt every day; you change shirts for different occasions. There is no formula for producing a certain mood; it must arise out of the performer’s desire to communicate” (Goll-Wilson 1987:5).

Toff (1996:114) is of the opinion that the speed of vibrato should be influenced by the tempo indication of the specific piece. She writes, “The speed of the vibrato should be coordinated with the speed of the piece, faster in allegros, slower in adagios. But short notes should be [without vibrato].” She further quotes Altés as saying, “No vibrato should be used if the metronome setting is ♩=120 or higher.”

Roger Stevens (cited in Toff 1996:114) suggests that, “In order to avoid destroying the continuity of the tone, never use vibrato in slurred passages where the number of vibrato pulses is equal to or less than the number of notes per second.”

Although these opinions might seem somewhat rigorous, the indicated tempo would have an effect on the musical mood that a composer requires, and should in turn have an influence on the choice of timbre. However, one should guard against using an exclusively bright timbre with fast vibrato for all *allegro* marked pieces and vice versa. The secret to an expressive performance seems to lie in the variety of musical moods, and therefore the variety of different types of vibrato that a musician is capable of creating.

Toff (1996:114) gives the following examples from the symphonic literature to illustrate how different moods might influence a flautist’s choice of vibrato:

In the last movement of the Brahms First Symphony, the flute must cut through the whole orchestra, which calls for relatively fast and wide vibrato. At the conclusion of Mendelssohn’s *Fingal’s Cave Overture*, slowing down and narrowing the vibrato enhances the final cadence. An intensity [as opposed to pitch] vibrato in Debussy’s *Prelude à l’Après-Midi d’une Faune* enhances the static nature of the c-sharp before the chromatic movement downward.

In the flute world, a new awareness of historically informed performance of music from earlier style periods relating to vibrato has been developing. Where flautists previously performed music with the vibrato that was congruent with their era's sound ideal, performers are now taking the specific era in which the different works were composed into account. Peter Lloyd's statement on performing Baroque works is representative of this new awareness:

I take [Bach] from playing dead and just moving up very slightly, because I believe that so much sostenuto playing gets ruined by vibrato ... If you play a lovely Bach with no vibrato it's more beautiful than hearing the wretched thing wobbling up (Krantz 2005).

According to Krantz (2005), Lloyd is very aware of the fact that mood can be conveyed by its attendant vibrato, and he often told students that the best vibrato for a passage is almost none. On the Ibert *Flute Concerto*, Lloyd states:

The ideal vibrato for this opening [second movement] is hardly anything ... The wider your vibrato, the more it's going to interfere with the pianissimo line. So really, a pianissimo line needs to be virtually non-vibrato, or else a French kind of shimmer ... In the Ibert we should be making proper sound based on French vowel sounds anyway, which will give us the French shimmer naturally (as cited in Krantz 2005).

Lloyd is also a firm believer that tempo indication should influence our choice in timbre and vibrato. In a master class, he said the following to a student: "Okay, can you give us more? ... It says *agitato*, doesn't it? – An agitated feeling? So give us a faster vibrato. Give us a feeling of agitation in the pianissimo ... A bit more scary" (as cited in Krantz 2005).

It seems that the most effective variation in timbre occurs when two seemingly opposing effects are applied (i.e. very expressive passage played with no vibrato and piano passage played with intense vibrato). According to Lloyd, the most common error amongst flautists is to play with a vibrato that is too wide and intense. He refers to Saint-Saëns' *Le Cygne* from the *Carnival of the Animals* as an example to illustrate his point. He argues that "[a] fast, deep vibrato – or even a fast shallow vibrato – would make a ludicrous

juxtaposition of mood. Yet, flautists continue to ignore the power of vibrato variation in regard to mood” (cited in Krantz 2005).

One would assume that a deep and fast vibrato would be more appropriate in the performance of a romantic piece, such as a Brahms sonata. This assumption however is incorrect. Lloyd (cited in Krantz 2005) states:

When style comes in, you’re not going to play Brahms with a whacking great fat vibrato. It’s not right ... I think you’ve got to remember that when Brahms wrote that piece, vibrato was still thirty years away in the way that we think of it now. And it didn’t really come in properly until the early 1920s ... we have to think carefully about the style of the pieces we’re playing.

Although it is crucial to consider the style of the music that is to be performed before a decision is made about the type of vibrato to use, it is the author’s opinion that these should merely serve as guidelines, not as an ultimate set of rules. When asked about the Mozart flute concerti, Lloyd answered as follows:

I’m not suggesting that you don’t use vibrato ... however, I do think that we have to think a little about cutting out this wobble that happens with some people ... we’ve got to learn the different speeds and the different depths according to the style of music we’re playing. (Krantz 2005).

Once these guidelines have been established, there is a reasonable amount of freedom within which a flautist can vary their vibrato. It is most important to be aware of the vast amount of possibilities that a varying vibrato can have on one’s performance.

Geoffrey Gilbert (cited by Krantz 2005) believes that since the vibrato sound ideal is a constantly changing concept, it is the responsibility of the next generation to determine how vibrato will be used.

Lloyd (cited by Krantz 2005) comments as follows:

I think of that as a very, very important point. Sometimes we don't want to get an intense sound going all the time – it's very boring. And unless we really find the possibilities, colour possibilities, vibrato possibilities, expression possibilities, we're going to go on producing recitals as they've been done for so long ... I think that's boring.

CHAPTER 4

A comparison between the applications of vibrato on the flute with that on other instruments

As already stated, the final aim of this thesis is not only to equip flautists with a greater knowledge of the phenomenon of vibrato, but also to aid them in the application of this knowledge within a practical context.

In this regard, one might well ask why one would examine the production of vibrato on instruments other than the flute when one is primarily concerned with the latter. It is the author's opinion that knowledge in regards to the production of vibrato on other instruments holds two important advantages for the flautist. Firstly, it will promote an understanding of how to adapt in order to blend more readily with such instruments. Secondly, although there are substantial differences between the flute and the instruments discussed, a greater understanding of vibrato on instruments other than the flute would foster a greater sense of musicality with regards to vibrato application.

Marcel Moyse was one of the many great flautists who believed that by looking at different instruments one could gain this greater sense of musicality and learn more about quality of tone and vibrato sound ideal. Moyse also believed that it is due to this mindset that he frequently received compliments such as the following regularly after performances: "Never could I have imagined it possible to be so expressive and so musically interesting on the flute" (Moyse 1960:1).

When asked about the secret of his striking performances, he responded by describing the way in which he had practised and performed all his life. This involved gathering melodies, pieces, concertos and sonatas which he would then analyse and try to hear performed by the great artists of his time (Ysaye, Enesco, Casals, Bussoni, etc.) as often as possible. Moyse would then aim to interpret these works as richly as these performers,

with the firm conviction that he was developing his artistic potential. He felt that this would allow him to achieve a rich tone that is diverse in timbre, intensity, finesse, opulence and flexibility, and that this would enable him to express all the sentiments embodied in a given musical phrase.

This chapter will be devoted to the study of vibrato application in different instruments. Firstly, the author will look at the actual vibrato production on the various instruments. Secondly, the author will refer to two specific case studies done on the comparison of vibrato on different instruments. The first, done by Timmers and Desain (1999), compares the performances of *Le Cygne* by Saint-Saëns by different instruments, referring specifically to the use of vibrato. The second study, done by Papich and Rainbow (1974), refers to a comparative study of vibrato used by several string instruments, evaluating the use of vibrato when playing within a string ensemble compared to that of the instruments playing the same piece as a soloist.

4.1 The production of vibrato

4.1.1 Reed instruments (clarinet & oboe)

Before analysing the production of vibrato on the clarinet, one first needs to examine some of the fundamental differences between the clarinet and the flute.

In the first instance, the clarinet is a reed instrument and the sound is produced by the vibration of the reed against the mouthpiece. It is therefore a combination of the reed vibrating against the mouthpiece, which results in a vibrating air column that creates the tone. In the case of the flute, a given tone results from a combination of embouchure as well as the angle at which the air is split when reaching the mouthpiece.

From this one can deduce that playing the clarinet requires control over the reed when producing a tone, leaving the player with less control over the vibrating column of air. Due to the absence of this limitation, the flute player can exercise more control over the

vibrating air column due to the looser embouchure. This enables the flautist to have more freedom to explore the different speeds at which the air can be made to vibrate and makes possible a greater variety of timbre and vibrato.⁴²

Instrumentalists generally agree that vibrato is used to embellish and add warmth to the tone of an instrument (Barmann 1918:441). However, some clarinetists believe that the tone of the clarinet can do without vibrato because of its pure and liquid quality. Paul Drushler writes that, in applying vibrato, with these differences of opinion noted, one should proceed selectively and sparingly as the music suggests (1978:675).

A second significant difference between the flute and the clarinet is the different types of vibrato used. According to Drushler (1987:675), there are two types of vibrato used on clarinet. On the one hand, there is pitch vibrato, produced by the finger, lip and jaw, which he describes as a “lowering and raising of pitch in a pulsating manner.” On the other hand, there is amplitude vibrato, produced by the diaphragm, throat and breath, which he describes as a “modification of the tone by decreasing and increasing the amplitude in a pulsating manner.” Although the two types of vibrato are theoretically separate, Drushler adds that it is indeed rare to hear a vibrato on a wind instrument that does not exhibit elements of both.

Apart from the two types of vibrato mentioned above, there is also a third type of vibrato, that could be described as timbre fluctuation which naturally occurs when vibrato is employed. According to Drushler (1987:675), the character of the vibrato ultimately achieved by a player is a summation of all three the above-mentioned types of modifications.

One notable difference, however, is the role that the clarinet’s reed plays in vibrato production. One advantage of the reed is that it allows the clarinetist to control the

⁴² It must be said that a comparison between the various registers of the clarinet and that of the flute will necessarily be subjective in nature. Although there is a significant difference between these two instruments as far as the timbre and character of different registers are concerned, the flute does appear to allow a greater variety of timbre on individual notes than the clarinet.

airflow in order to obtain vibrato purely by using the lip and jaw, that is without having to alter the speed of the air for this purpose. The reed, however, poses the disadvantage of inhibiting the player when performing with a pure amplitude vibrato as a flautist would do. This makes it possible for the flautist to control not only the tone more, but, more importantly, it enables the flautist to play with greater amplitude variations.

Timmers and Desain⁴³ conducted a study in which an oboist was asked to perform *Le Cygne* by Saint-Saëns. The participating oboist, named only as HR, used vibrato as an aid in producing a timbre deemed appropriate in light of the character of the passage in question. Furthermore, HR believed that the passage in question required a “subtle” and “soft” tone, and consequently that a small vibrato was fitting for performance. In addition to this general approach, HR placed a slightly greater stress on the more important notes in the phrase by employing a more intense and faster vibrato in such instances.

Lastly, HR expressed the view that the rate and extent of vibrato wane if a given tone presents a greater resistance. To this is added that the rate of vibrato increases with the loudness of tone and is influenced by the rhythm of the accompaniment.

4.1.2 String instruments

Before beginning a comparison between vibrato on the flute and vibrato on the violin, one must first examine the various differences between the former as a wind instrument and the latter as a string instrument. A consequent examination of the production of vibrato on the violin will also be necessary before it can be compared to the flute.

The most significant difference in violin and flute vibrato is that the violin uses mostly pitch vibrato, whilst the flute uses both amplitude and timbre vibrato.

⁴³ Published in the article “Vibrato: Questions and answers from musicians and science” (2000) in *Proceedings of the Sixth international conference on music perception and cognition*.

In the first instance, the violin is a string instrument and therefore does not require a concentrated air stream to induce the production of a specific tone. While this may seem like stating the obvious, it is however important to emphasise that neither facial nor abdominal muscles are involved in producing sound. The production of vibrato in the case of the violin is thus effected by means of an external (e.g. the violinist's wrist) rather than an internal impetus (e.g. the flautist's diaphragm, throat or facial muscles). It is perhaps on account of this that vibrato on the violin is not generally such a subjective and contentious issue as in the case of wind instruments. Vibrato on the violin is something that is clearly visible, and it can be physically corrected by a teacher and imitated by a pupil through visual observation.

Nevertheless, the kind of vibrato in general use today did not always constitute standard practice. The development of violin construction has been one of the most significant influences on the changes in violin tone. According to Dart (1963:35),

String-tone, for instance, has changed very much indeed, the factors chiefly responsible for the change being the use of wire strings for the topmost strings of a violin or a 'cello; the violin chin-rest and the 'cello spike; the modern large-sized viola; and the modern technique of the double-bass. The true gut-strung tone of a violin is now as obsolete as the tone of a crumhorn or a regal.

Although one might have thought that the wider, quicker type of vibrato that became possible as the violin developed would have been adopted as standard practice, this does not appear to be the case. It would seem that violinists were faced with similar challenges and decisions with regard to vibrato in earlier periods. Dart (1963:35-36) provides the following illustration:

As in instrumental playing, vibrato was employed only as an occasional ornament in early vocal music. In the eighteenth century, Geminiani (1751) appears to have attempted to introduce a more pervasive style of vibrato into violin technique; it is interesting to note that this was resisted by his English publisher, who suppressed the relevant passage in the 1777 edition. It must, however, be stressed that any reference to vibrato prior to the late nineteenth century must be taken to indicate the subtle sense of the word; it was not until then, with the invention of the violin chin rest and 'cello spike, that the fingers of string players were able to perform a tireless twitch about the note.

Even in the twentieth century, some teachers advised their students against vibrato on account of the misuse that often accompanies it, e.g. to hide bad tone quality and intonation. Eugene Ysaye (Szigeti 1979:173-174) related how his first teacher, his father, Nikolas, furiously admonished him on this account at the age of five or six: “What! You already use *vibrato*? I forbid you to do so! You are all over the place like a bad tenor. *Vibrato* will come later, and you are not to deviate from the note. You’ll speak through the violin.”

This was around 1863. Szigeti (1979:173-174) later said, upon listening to Eugene Ysaye’s 1912 Colombia USA recording: “Listening to the beautiful, chaste, close vibrato I feel that this paternal admonition bore fruit in Ysaye’s unthrobbing, lovely cantilena as I still remember it.”

Since this time, the type of violin vibrato used today has more or less become standard practice. Nonetheless, the question of the historically informed use of vibrato still appears to be a point of discussion, even amongst instrumentalists playing on so-called modern instruments. Bukofzer (1947:377) summarises this question as follows:

There is no place in baroque music for the perpetual string vibrato that ‘graces’ modern violin playing. The references to the vibrato which appear first in the lute instructions of Mersenne and Mace, and later in Merck’s violin tutor, bear unequivocal proof that vibrato was, like crescendo, a special ornament, indicated by a symbol of its own and to be used with discretion only at the proper places.

However, when listening to the great violinists of our time, we can assume that the vibrato that we are used to hearing today will be the sound with which flautists should be able to blend.

The production of vibrato on the violin will be examined before a comparison with the flute will be made.

There are three main types of violin vibrato production, namely:

- **Arm vibrato**, which involves using the arm to produce vibrato while keeping the wrist straight. This type of vibrato is useful for students experiencing difficulty in producing wrist or finger vibrato due to a lack of dexterity in the wrist and/or fingers. It can also be used to great effect in passages that require an aggressive and very wide vibrato.

- **Finger vibrato**, which is produced by the finger while keeping the elbow stationary and the wrist fairly straight. This type of vibrato can be useful in passages requiring only a slight vibrato exhibiting only a small change in pitch. However, like arm vibrato, it is not used very frequently.

- **Wrist vibrato**, which is the method of choice for both students and professionals. This preference can probably be attributed to the versatility of the approach and the ease with which it can be applied. Professionals advise students to use this as their main vibrato technique, and to save the other two for rare occasions.

In Timmers and Desain's (2000) case study, a participating violinist, referred to as RK in the article, was asked to perform *Le Cygne* by Saint-Saëns. Vibrato was achieved by means of a quavering of the left hand whilst depressing a given string. The result was a regular fluctuation around the central pitch, with this fluctuation being controlled by the fingers, hand, arm or a combination of these. RK performed the chosen passage with a relatively large vibrato, and expressed the opinion that the function of the vibrato was to add colour to the tone. The vibrato applied by the latter participant did however stay more or less constant throughout the passage.

The participating cellist, to whom the article refers as JI, is of the opinion that vibrato is a quite natural technique that is easily learnt. Furthermore, JI expressed the opinion that the function of vibrato in the piece in question aids in achieving a legato performance and of a warm and lyrical sound.

Timmers and Desain (2000:4) provided the following summary of JI's use of vibrato in the chosen passage:

Vibrato was used as part of the phrasing of the music. He used a kind of vibrato that is not too fast and not too exuberant. Some notes of the phrase got stress by giving them a more full sound, which means that he performed those notes with a more expressive and faster vibrato, and with more 'meat' of the fingers. The end phrases 'died' away, which was accompanied by a smaller vibrato. In general no note was performed the same or with equal vibrato.

The Papich and Rainbow case study (1974) only dealt with the vibrato production of string instruments, comparing the string players' vibrato when playing in a solo context with their choice of vibrato in an ensemble context. Papich et al. (1974:24) describe the aim of their study as follows: "The purpose of the study was to investigat[e] ... [the] ... characteristics of intonation and pitch vibrato of performers of stringed instruments.

Insight gained from this study was that all the string vibratos in the study did not oscillate circumjacent to the tone, but oscillated in an upwards motion from the pitch. This is of great importance to a flautist, since the flute's vibrato (consisting of both amplitude and pitch vibrato) oscillates around the central pitch. This will have a great effect not only on blending with string instruments, but also on the intonation of the ensemble, an observation which is, significantly, absent from the study referred to above. Furthermore, the results showed that pitch vibrato was present in the attack of all of the notes, and that the width and speed of the vibrato were consistent, whether the musicians were playing solo or in an ensemble.

In all the recordings, Papich et al. found that the instrumentalists consistently played with less vibrato when playing in an ensemble. Due to the pitch fluctuation occurring in an upwards motion from the central pitch, Papich et al. also found that "[p]itch vibrato was noted in the attack of all notes and appeared initially as a sharpening surge ... in the cases of observable pitch errors, the errors appeared to be on the sharp side" (1974:27).

The use of vibrato was also used in the aid of adjusting intonation by all string instruments.

The cellists used their vibrato to help them reach a consensus pitch in ensemble performance. When a performer perceived that his note was lower in pitch than that played by the section, a wider vibrato was used to bring the initially conceived note in closer agreement with the note played by the section ...It was observed that [with violinists] if the pitch was sharp, the top of the vibrato oscillation modulated downward toward the bottom of the oscillation. If the pitch was perceived to be flat, the bottom of the oscillation modulated upward (Papich et al 1974:30-32).

This method of reaching a general consensus in pitch is extremely effective and would be one of the most successful ways that a flautist could utilise their easily adaptable varieties of vibrato.

4.1.3 The voice

The vibrato of the singer bears many similarities to that of the flute. As in the case of the flute, the singer uses the diaphragm and/or throat to obtain vibrato. This not only complicates the teaching of vibrato in singing, but also creates similar problems to those encountered by flautists. Consequently, the type of vibrato that flautists use often strongly resembles that employed by singers.

It seems that, similarly to the flute, there has been numerous discussions and opinions noted on the use of vibrato. The universal sound ideal of today has developed over numerous decades, and is still under constant debate.

Probably the earliest mention of the use of vibrato in the literature on singing refers to that of the tenor Rubini. In an article written by Lester S. Butter (1908), titled “The singer’s tremolo and vibrato – their origin and musical value”, the writer states that Rubini’s voice “small in the beginning, developed marvellously in tone volume and the

swell and diminish of tones (*messe di voce*⁴⁴) called by the Italians ‘vibrato of voice’ was the characteristic of his style” (cited in Alverson 1913:172).

It would seem, however, that although some musicians embraced this kind of vibrato, some were fiercely opposed to it. Butter (cited in Alverson 1913:173) states later in the same article that “this ebbing and flowing undulating wave of sound upon sustained notes was the source from which sprang the modern tremolo and vibrato, which is so much in evidence among singers and so offensive to all really refined musical taste.”

W.J. Henderson (cited by Alverson 1913:172) on the other hand states in *The Art of Singing* that “it is by the emission of tones swelling and diminishing that we impart to song that wave-like undulation which gives it vitality and vivacity.”

Grove (cited by Alverson 1913:175) provides a different perspective on the matter of Rubini. He says that Rubini “was the earliest to use the thrill of the voice known as vibrato (the subsequent abuse of which we are all familiar) at first as a means of emotional effect, afterwards it was to conceal the deterioration of the organ.”

In a letter to Dr S.B. Matthews (cited by Alverson 1913:176), L.G. Gottschalk gives his opinion on the matter so succinctly that no doubt remains as to his position on the subject: “Tremolo of the voice is the result of either of the three of the following causes – diseased vocal organs, old age, or defective breathing, and as such has no excuse for its existence.”

Even if one looks at the definition of vibrato in the *LaRousse encyclopaedia of music* (Hindley 1971:547), expecting to find a more of less objective discussion, one is confronted with the following scathing remark:

⁴⁴ This term refers to a technique involving an increase and consequent decrease of loudness while sustaining a single tone. This technique was especially important during the eighteenth century (Karp 1973:340).

Vibrato. An effect, once an ornament but now a standard part of tone production ... with singers, the louder the note, the more pronounced, usually, the vibrato – and the oscillation can become so wide that the hearer may be left in doubt as to which note is being aimed for. If the technique is applied, as it often is, to a fairly rapid passage, the result is quite unnerving and totally unmusical (except, apparently, in the opera house).

There are some teachers who are of the opinion that it is damaging to the vocal chords to sustain straight notes and that this is a bad habit forced upon singers in choirs whilst others maintain that singing with vibrato is unmusical.

Despite these disparate views and opinions, one is able to compile a number of guidelines about the use of vibrato, whether one is a flautist, singer or violinist. Firstly, moderation is the key. Special care should be taken when vibrato with great amplitude variation is being used. Secondly, vibrato should not be used in music where it is not appropriate (e.g. in fast passages) and should always be chosen with great respect for the type of music that is being performed. Walstun (1986:229-233) makes the following statement in this respect:

The technique of the Romantic voice not only makes the agility and clarity of the treble voice a physical impossibility, but it rules out the use of the trill, which was coming into fashion at the end of the Tudor period. Ironically, the retracted larynx position engenders the use of vibrato, which is then indistinguishable from the trill ... the combination of undifferentiated vowels, loud but dull tone, and wobbles, is antipathetic to the performance of polyphonic music.

In the case study by Timmers et al. (2000), the participating tenor, to whom the article refers as AO, expresses the belief that a singer will naturally be inclined to sing with vibrato if he or she breathes correctly and maintains a steady, fluent airflow. In performing *Le Cygne*, he had to sing the melody on a single vowel, without text, in an effort to make the voice more comparable to the other melodic instruments.

The article specifically emphasises that AO sang the passage in question in its entirety with the same vibrato. The only differentiations made were stopping or starting the vibrato. In an approach that differs from that of the participating instrumentalists, AO

began the long a' without vibrato, only introducing vibrato halfway through the length of the note. In the section of the chosen passage vibrato was hardly used, possibly because AO's vibrato did not possess the necessary agility. AO also expressed the opinion that vibrato slows down as pitch ascends and that it becomes faster as the dynamic level increases.

4.2 Original study

4.2.1 Motivation

In order to test the validity of the before-mentioned case studies, the author conducted a similar study to that of Timmers and Desain. All of the accomplished musicians taking part in this study were lecturers at Stellenbosch's International Chamber Music Festival. The musicians participating were Peter Martens (cello), Leon Bosch (double bass), Emile de Roubaix (viola), Paul Voet (trumpet), Abel Perreira (horn), Rick Huls (clarinet), Lecolion Washington (bassoon) and Tim Roberts (oboe).

4.2.2 The musicians⁴⁵

PETER MARTENS studied at the Mozarteum (Salzburg) under Prof. Litchauer. During his time in Salzburg, he was solo cellist of the Austrian Ensemble for Modern Music and principal cello of the Salzburger Musici Chamber Orchestra. He also had master classes with Heinrich Schiff, William Pleeth and Ivan Monigetti. Peter was co-principal cello of NAPOP (New Arts Philharmonic Orchestra Pretoria) and principal cello of the Chamber Orchestra of South Africa. He is presently the principal cello of the Cape Philharmonic Orchestra, while maintaining a very active career as soloist and chamber musician. In addition, he is also a part time cello lecturer in Cello Performance and Orchestral Studies at the University of Cape Town, having previously occupied a similar position at the University of Pretoria. Peter has recorded solo and chamber music for the SABC and has made two CDs with his group "Cellissimo" in Pretoria.

⁴⁵ Information is quoted from Stellenbosch's International Chamber Music Festival Brochure (2007).

LEON BOSCH has an honoured place among the select group of virtuoso double bass players worldwide. Concerto engagements in many parts of the world with the likes of conductors Pinchas Zukerman, Nicolas Kraemer, Nicolae Moldoveanu and Guido Johannes Rumstadt have been matched by collaborations with a long line of leading chamber music groups - among them the Lindsay, Belcea and Brodsky string quartets, the Academy of St Martin in the Fields Chamber Ensemble, the Moscow Virtuosi and the Zukerman Chamber Players. Partnerships with solo performers have embraced such pianists as Peter Donohoe, Vladimir Ovchinikov, Mikhail Rudy and Maria João Pires. Leon Bosch has a growing discography of concerto and recital recordings. This will shortly include two albums devoted to the music of the great Giovanni Bottesini and another featuring music by British composers. Other recordings that are still in the pipeline, is a disc of Russian music and another of compositions by Domenico Dragonetti, there are also talks of the complete works for solo double bass by Dittersdorf, Menotti's concerto and recordings of a string of neglected concertos for the instrument.

EMILE DE ROUBAIX is currently studying a Masters in Music Performance at the Royal Northern College of Music under Predrag Katanic (viola) and Annette Isserlis (baroque viola). He has been an active chamber and orchestral musician since 2002 and has played for the Orchestra of the Age of Enlightenment (conducted by Simon Rattle and Thomas Zehetmar), Orchestra dell' Academia (Settimane Musicale Festival, Italy), Sinfonia Cymru (Wales), RNCM Symphony and String orchestras and Cape Philharmonic orchestra. He has been active in many different RNCM chamber groups since 2005, which includes collaborations with the Mariani string quartet and Rhodes Trio, as well as being a member of the Mzansi Ensemble (specializing in the performance of traditional south African kwela music, winner of the RNCM Granada Prize for mixed chamber music ensembles) and the Diamond Quartet, who collaborated in concert with the Smith and Myrios Quartets, and won the RNCM Nossek Prize for string quartets. Emile has received master classes from numerous string players, amongst others that of Thomas Riebl (RNCM), Susan du Bois (Stellenbosch), Jan Repko (Stellenbosch), Michael Tseitlin (Portugal), Christian Altenburger (Vienna), Philippe Graffin (Courchevel), Daniel Rowland (Portugal), Jerusalem String Quartet (South Africa) and Eugene Fodor (South Africa).

PAUL VOET obtained a higher (virtuoso) diploma in trumpet at the Royal Conservatory in Ghent and a master's degree in trumpet at the Lemmens Institute in Leuven. He also studied trumpet and baroque trumpet at the Hochschule für Musik in Cologne (Germany) with Prof. Friedemann Immer (1987-1989) and trumpet and baroque trumpet at the Summer Academie at Dijon (France). He has received master classes from, amongst others, Charles Schlueter, Maurice André and Fred Sauter. From 1986 to 2002, Paul was principal trumpet in the Symphonic Orchestra of Flanders. He was also, for many years, principal trumpet of the Belgian Brass Ensemble and is a founding member of the Brussels Trumpet Choir. As a freelance trumpeter, he has played in every major orchestra in Belgium (Radio Orchestra, National Orchestra and various opera company orchestras). He is conductor of the Brass Band *Pant Rhei Ghent*, a group of talented amateur brass players from the Ghent area. From 1999-2004, the group was named national champions (in their section) for VLAMO. At present, Paul teaches brass instruments and brass ensemble (brass band) at the music academy of the Flemish community in Ghent. He started up brass in the school, which at present boasts 110 brass students. Prior to 1994, he taught in Brussels and was also assistant lecturer in trumpet at the Royal Conservatoire of Ghent. He collaborated in several CD recordings and productions for radio and television in Belgium and abroad. For the same purposes he toured in Germany, Luxembourg, South Africa, Italy, Spain, France, Brazil, the UK, Holland, USA, Austria, Switzerland and Israel. Paul is furthermore devoted to composing for brass and wind band. Lately he has released several arrangements and compositions for brass band, including 'Global Reunion', a 6-part concept piece, as well as 'Memorials of Flanders Fields', released by Molenaar Edition in Holland.

Since his first solo performance at the age of 11, **ABEL PEREIRA** has appeared as a soloist with orchestras, in chamber ensembles and in recital throughout Europe, Asia, Africa, South America and the Middle East. He studied at the University of Oporto with Bohdan Sebestik and in Germany with Marie Luise-Neunecker and also received tuition from Hermann Baumann, Stefan Dohr, Jeffrey Bryant, Radovan Vlatckowich, the Prague Horn Trio and the German Horn Ensemble. He was awarded numerous prizes in various

international competitions, including Leeuwarden (Holland), Makneukirchen (Germany), Concertino Praha (Czech Republic) and first prize at the Young Musicians Awards, presented by the RDP (Portugal). From 1995 to 2001, he performed with the European Community Youth Orchestra, appearing in some of the most prestigious venues in Europe: the Royal Albert Hall in London, the Musikverein in Vienna, the Berlin Philharmonie (as principle horn), La Scala in Milan, the Cité de la Musique in Paris and the Concertgebouw in Amsterdam. In addition, he has worked with such distinguished conductors and soloists as Carlo Maria Giulini, Mstislav Rostropovich, Bernard Haitink, Sir Colin Davis, Vladimir Askenazy, Claudio Abbado, Emanuel Ax, Radu Lupu, Marta Argerich and Barbara Hendriks.

In 1998, Abel was awarded the coveted EUYO Master Prize by Vladimir Askenazy, Bernard Haitink and Prof. Lutz Kohler. He has performed as a soloist with some of Europe's finest orchestras and has recorded for various European radio and television stations. In 2001, he recorded a CD with contemporary pieces for solo horn and piano and in 2002, recorded the Mozart horn concertos with the Lisbon Metropolitan Orchestra. Since 1996, Abel has presented master classes in Lisbon, Santa Maria da Feira, Lousada, Caldas da Rainha, Mirandela, Macau, Bombay, Cabo Verde, the UK, at the Bisycoc International Festival. In 2004, he was invited to perform as soloist in the International Horn Festival in Spain. He is a founder member of the Artziz Quintet and the Oporto Brass Quintet and teaches at the Professional School of Music in Espinho and at the Superior School of Arts in Castelo Branco. He is currently principal horn of the Oporto National Orchestra. During the 2003/4 season, Abel performed in recitals in Portugal, Spain, Brazil, UK, Estonia and France. His future engagements for the 2004/5 season include concerts in Portugal, the UK, Spain, Brazil, Switzerland, Germany and South Africa and a new recording of recital pieces with piano accompaniment.

RICK HULS studied clarinet with Reinier Hogerheijde and George Pieterse. During his studies he won various awards, including second prize at the International Clarinet Competition in Gent (Belgium) and first prize at the Colmar Chamber Music Competition (France). In addition, he participated in master classes with Hans-Rudolph Stalder, Karl Leister and Hans Deinzer. Following his studies, Rick was active as a freelance clarinetist

with Dutch orchestras and ensembles, including the Royal Concertgebouw Orchestra, the Rotterdam Philharmonic Orchestra and the Asko-Schoenberg Ensemble. As a chamber musician he has appeared frequently at music festivals with Lucy van Dael, Anner Bijlsma and Reinbert de Leeuw. He is also co-founder of the Uriel Ensemble (piano, violin, cello and clarinet). Solo engagements include performances of Aaron Copland's Clarinet Concerto with the Holland Symfonia under conductor Roy Goodman. In 2003 Rick was appointed principal clarinet of the Netherlands Philharmonic Orchestra in Amsterdam.

LECOLION WASHINGTON received his BM in Music Studies from the University of Texas at Austin and a MM in Orchestral Performance from the Manhattan School of Music. He also did further study at Southern Methodist University. His principal teachers have included Kristin Wolfe Jensen, Frank Morelli, and Wilfred Roberts. Washington has performed with the Austin Civic Chorus Orchestra, New Texas Festival Orchestra, Mid-Texas Symphony, Garland/Las Colinas Symphony Orchestra, and Victoria Symphony Orchestra where he was principal bassoon. While in New York City, Washington performed with the Riverside Symphony Orchestra and the Manhattan Chamber Orchestra as principal bassoonist. He has won orchestral auditions with the Houston Grand Opera and Shanghai Broadcasting Orchestra, performed with the Memphis Symphony and currently serves as co-principal bassoon of the Missouri Chamber Orchestra. In addition to performing chamber music with principal players from the New York Philharmonic, Professor Washington has performed chamber music with the Circadia Wind Quintet, New York Chamber Ensemble, and the North Country Chamber Players with principal players from such orchestras as the Minnesota Orchestra, the Orpheus Chamber Ensemble, and the Los Angeles Philharmonic. In 2004, The Orchestral Performance Program at the Manhattan School of Music invited him to perform on a chamber music concert of distinguished alumni. Professor Washington has attended the Texas Music Festival, Cape May Music Festival, and the International Festival Institute at Round Top where he was the Concerto Competition Winner. He also won the Southern Methodist University Concerto Competition. Professor Washington has given recitals and master classes at The University of North Texas, Baylor University, and The University

of Texas at Austin. He served as the Assistant Professor of Bassoon at the University of Missouri-Columbia and bassoonist for the Missouri Wind Quintet, before joining the Memphis Wind Quintet and faculty of the Rudi E. Scheidt School of Music in 2004.

TIM ROBERTS was a chorister at St. Chad's Cathedral in Birmingham (UK) under John Harper. After playing the oboe at school, he went on to study oboe and piano at the Royal Academy of Music in London. As a student at the academy, he won the Croft Prize for chamber music and the Gillet Prize for oboe. He then spent a period playing for the English Touring Opera Company and travelled extensively with different productions. Back in SA, he spent some time with the National Chamber Orchestra and became principal oboe with PACT in Pretoria. He is currently a member of the Chamber Orchestra of South Africa, as well as a member of its management team. He is Artistic Director of Apple Green Opera, based in Hammanskraal, Tshwane, a director and educator for STTEP music school, based at The University of Pretoria, and principal conductor of the Pretoria Sinfonia. Tim has recently played concerto concerts with the JPO, including the Bach Oboe and Violin Concerto with Philip Graffin. He has been invited to record the Lebrun oboe concertos in the UK in October this year. He teaches and examines for universities across South Africa and has been invited to conduct in Washington (US) next year.

4.2.3 Method

The eight musicians were asked to perform Rachmaninoff's Vocalise on their respective instruments. The musicians could stop at any moment and repeat phrases that they were not entirely pleased with, in which case the previous take of that certain phrase was not included in the study. The author recorded these sessions with ProTools 7.1 for Apple Macintosh and analysed the recordings in wave format in QuickTime (also Apple software). The instruments⁴⁶ recorded were viola, cello, double bass, flute, oboe, clarinet, bassoon, horn and trumpet.

⁴⁶ Although the author tried to record a violinist and soprano, the artists were unfortunately unavailable for the study.

4.2.4 Findings

As with previous studies, the author found that the opinions and application of vibrato varied widely between the musicians. The string players' vibratos were the closest to that of the flute in terms of width and speed. There was no audibly noticeable vibrato in the clarinettist's performance, whilst the oboist used a relatively shallow vibrato compared to that of the flute and strings. The horn player (who admitted that he applies vibrato more freely than his peers do) had a similar vibrato to that of the trumpet, which was shallower than that of the oboe and relatively slower when compared to the flute and other instruments.

In all of the instruments vibrato was only used on the longer notes of the piece, and no vibrato was present in any of the quavers. Vibrato was applied to change the colouring of notes, create movement in a phrase (from one note to another) or in some cases to contrast previous long notes played without any vibrato.

In the string players, the author found that the dynamics and harmonic tension in a phrase had a direct influence on the width and frequency of the vibrato. Notably, in the case of *Vocalise*, the moments of highest tension were present in the highest register of the piece, which resulted in the widest and fastest vibratos. There has however not been enough evidence to conclude that register influences vibrato. The string players were the most agile in terms of varying their vibrato, varying between a note starting and ending with a constant vibrato or playing notes with a slight increase or decrease in width and speed.

The trumpet, horn and oboe, however, played their notes with a consistent sounding vibrato, never varying in speed or width, unless a pianissimo was indicated (at the end of the piece), in which case the speed and width diminished in all three of the players' performances. This can be ascribed to the limitation of the instruments, the reed and the required tension in brass players' embouchure, or it could simply result from differing personal taste. In these cases, vibrato was merely used to colour the tone and could be seen as ornamentation, due to the limited use of vibrato as an expressive device.

Where the string players used vibrato on notes that were difficult to intonate, the trumpet, horn and oboe played all of these long notes without any vibrato, indicating once again how the wind instruments' embouchures have a limiting effect on vibrato production. The flute, on the contrary, has a relatively loose embouchure when compared to these instruments, which enables flautists to have more freedom when varying their vibratos.

These results prove what has been discussed before. After singers, the flute's vibrato is most similar to that of a string instrument, making a blend between these two instruments the easiest in an ensemble context. The visibility of the string player's vibrato also aids in making it easier to see how wide or fast the vibrato is that a flautist has to adapt to.

When the flute is paired with the oboe, a slight adjustment would have to be applied in terms of width of the vibrato. A flautist would be required not to have a vibrato that is too wide in order to avoid clashing with the vibrato that the oboist uses. It is imperative, however, that the sound ideal of a work should be studied. If a flautist has a part that is more solistic in nature, the player will have more freedom of choice in their vibrato, but if the flautist is required to blend with the oboe, forming a unified timbre, the flautist will have to adapt accordingly. The same guidelines apply when a flautist is required to play with horn or trumpet players. Since clarinet and some brass players use no vibrato, blending becomes even more difficult for the flautist.

The amount of vibrato that each instrumentalist utilises may differ from one individual to another, and it is therefore imperative for a flautist to be sensitive to these varying timbres in order to blend appropriately. In numerous situations, it may be necessary to play without any vibrato if a certain instrumentalist plays in this way. Once again, if the specific piece requires the flautist to take on a more solo role compared to these instruments, the flautist will have more freedom in his or her choice of vibrato.

4.3 Conclusion

It would be incorrect to assume that all string and wind players, for example, achieve vibrato in the same way. The achievement and application of vibrato can still differ markedly between musicians playing the same instrument and it is consequently of great importance to pay close attention to one's fellow ensemble members in order to perceive and understand their vibrato. This will enable flautists to make the adjustments necessary for achieving a unified sound. Nevertheless, there are still noticeable general tendencies within instrumental groups of which a flautist must be aware.

When playing with a reed instrument, be it in an ensemble or in an orchestra, the flautist must keep in mind that, due to the limitations that the reed has on these instruments' ability to produce vibrato, the sound of the flute's vibrato will clash with that of the clarinet if too severe amplitude variations are applied. Flautists should therefore be careful to regulate their vibrato to be both tasteful and to match the degree of amplitude variations the clarinetist is employing.

Despite what has been stated above, a musician must remain sensitive to the role that his or her instrument is required to play within a given composition. In some cases, the specific reed instrument and flute are in fact not on equal footing and one can approach the application of amplitude variation more flexibly. When the flute is expected to form a unified timbre or sound ideal with the specific reed instrument, the flautist must however adapt accordingly and match the degree of amplitude variations as closely as possible on the reed instrument.

When playing in an ensemble it is important to strive towards your sound blending well with the rest of the ensemble, especially when making use of vibrato. Blending with string instruments is, however, even more difficult than blending with woodwinds when timbre is concerned. This can be attributed to the great difference between strings and woodwinds, and to the fact that violinists are usually capable of producing different types of pitch vibrato, i.e. both in amplitude and frequency, and the flautist must try to imitate

these in order to form a sonorous ensemble. The fact that most of the other woodwinds (such as the oboe, bassoon and some clarinets) use a much smaller or even no vibrato makes it easier to match the type of vibrato with a string instrument, because the amplitude vibrato of these two instruments are more alike in size and frequency.

With regards to combining flute and violin in an ensemble, it is important for the flautist to take cognisance of the fact that the violinist primarily produces a pitch vibrato. This will necessitate the flautist to concentrate more strongly on the pitch component of his/her vibrato. He/She will have to bear in mind that arm vibrato effects the widest fluctuation and finger vibrato results in the least degree of pitch fluctuation, so that he/she can adapt accordingly.

An example of this is found in Beethoven's Serenades (Opus 25) in D major, written for flute, viola and violin (see example below).

Trio (Serenade) Op. 25

Ludwig van Beethoven

Entrata. Allegro (♩ = 108)

Flauto

Violino

Viola

10

cresc. f

cresc. f

cresc. f

In other cases, the flute is treated as a soloist and is therefore not expected to match its vibrato exactly with the string instrument/s. With the latter performing an accompanying role, the flautist has more freedom in his or her choice of type of vibrato. In such instances, the flautist can employ vibrato as seems musically appropriate. Such instances can be found in some of Mozart's flute quartets (see example below).

Flute Quartet in D major

(Köchel No. 285)

Wolfgang Amadeus Mozart

Allegro.

Flauto traverso.

Violino.

Viola.

Basso.

10

p

It is important to agree on a specific style or degree of vibrato within an ensemble. The problems of the application of vibrato are not limited to flautists alone. Although one will not always be able to reach a compromise with regards to vibrato, playing in an ensemble implies that players should strive to blend together and strive for a unified sound ideal (in terms of both timbre and vibrato), regardless of what music is being performed. Lehman-Waffenschmidt (2002:2) points out that “[n]othing in flute playing is as intimately linked to a flautist’s personality and is moreover responsible for his effect on his audience as his/her application of vibrato.”

The musicians participating in my case study not only applied different phrasings to the same passage, but they also expressed divergent opinions as to the function of vibrato. It is exactly these divergent approaches to and opinions about vibrato that one has to reconcile when performing in an ensemble.

As far as issues of phrasing and important notes are concerned, the musicians playing in an ensemble can discuss these with the aim of reaching either an agreement or a compromise. A greater challenge, however, is posed by the contrasting ways in which different musicians approach the production of vibrato.

The string players in Papich et al.’s study, for example, expressed the belief that vibrato should start on the actual frequency of a given note and should then fluctuate between that tone and the tone a semitone higher. The wind players, on the other hand, believe that the frequencies covered by vibrato should be circumjacent to the central tone. If this difference in approach is not taken into account when the respective instruments are required to play together in unison the impression could be created that the instruments are not in tune. This problem could be alleviated if each member of an ensemble takes cognisance of the ways in which the other members produce vibrato. This would allow the various members of an ensemble to accommodate each other by making slight adjustments to their own vibrato technique, thereby making a more unified sound achievable.

This situation within ensemble playing acted as impetus to the present analysis of the phenomenon of vibrato, with the aim of promoting a better understanding of the production of vibrato on different instruments.

Ultimately, vibrato is a very subjective issue and compromise is almost inevitable, since it is difficult to speak of a right or a wrong way of utilizing vibrato. For example, the oboist mentioned in the Timmers et al. study brought out important notes by adding vibrato, while the thereminist tried to achieve the same emphasis by omitting vibrato on notes that are to be stressed. The members of an ensemble will have to discuss these diverse opinions in order to make sure that everyone uses the same type and degree of vibrato, or indeed refrains from such applications in the same way and to the same extent to stress important notes in a given piece.

James Galway discusses this meeting of minds in a chapter devoted to chamber music in his book *Flute* (Yehudi Menuhin Music Guides):

Chamber music is a more egalitarian business altogether. Even when one of the players is foremost among equals, the chances are strong that the rallentando and the musical idea have been arrived at by the meeting of minds; if not exactly by majority vote ... chamber music stretches the mind and imagination in a particular way. You become very much aware of the individual styles of playing; you get to know intimately the problems and the possibilities of other instrumentalists (1982: 205, 208).

The flute in an orchestral context

(Vibrato) ... is regarded as essential for giving the flute the brilliance and projection needed for it to be heard in our modern symphony orchestras and in our stadium-sized concert halls (Solum 1992:17).

A new set of problems arises when flautists have to adapt to their role in an orchestral context. The struggle for the flute, with its extremely fragile sound, to be heard above orchestras, pianists and ensembles has been enormous and still is. Many flautists have

compromised their timbre (and application of vibrato) simply to be heard. Rampal, however, played with “delicacy of colour, and yet filled the halls with his sound” (as cited in Solum 1992).

Another important factor that comes into play in an orchestral context is the unique sound quality and “personality” that different orchestras possess. Galway (1982:186) describes this as follows:

... listening to music on record, you will already have discovered that orchestras have a personality and a sound that distinguish them from one another. They get that way by choice, not by accident, so it behoves an intending recruit to take account of the preferred style ... more specifically, style affects the woodwind section and flute playing in particular. For example, in the Vienna Philharmonic, the woodwinds do not use vibrato. All the notes come out absolutely clear. In France and England, on the other hand, everybody uses vibrato, and in America, most do.

This tonal character is usually determined amongst the woodwind section, but in orchestras with resident conductors, the conductor could have a great influence on the type of vibrato that an orchestral flautist has to employ.

Of all the treatises by modern flautists (i.e. flautists using vibrato as it is known today) that I have read, only Edwin Putnik states that the application of vibrato should differ when comparing the flute as a solo instrument and the flute as an ensemble player. He states that “control of both speed and amplitude of vibrato is most desirable in flute playing because of the extensive variety of musical requirements” (1970:75).

It must be noted that if flautists refrain from adjusting their vibratos within their ensemble, the result will not only be unpleasant to the ear, but could also result in “clashing” with each other, the result being that the instruments will sound out of tune. James Howard Chandler writes in his treatise *Intonation: A source of information for the university wind ensemble conductor* that “different types of vibrato could produce inconsistent variances in pitch” (1981:61).

One cannot play in an ensemble and not listen to the types of vibrato that are produced by the other players, but flautists today still lack a concrete, written source for guidance in this respect and are therefore not equipped to make an informed decision as to the way that they should adapt.

Blending with other flautists

Whether you are playing in a flute quartet or as an orchestral player, you are at some stage going to have to adjust your sound or vibrato to blend with another flautist. If it is simply the extent of the vibratos that differs, one could easily adjust the amplitude or frequency of one's vibrato, but when another flautist is of a different school, it becomes a little more difficult.

It is imperative for flautists to develop their listening skills, not only in recognising the different vibratos that the great flautists use, but also to be constantly aware of their own vibrato, which would enable them to imitate and experiment with these different types of vibrato. By continuously studying and practising different types of vibrato, flautists would be able to put these to use when expected to match and blend with another flute, an ensemble, or the woodwind section in an orchestra.

As in chamber music, in an orchestral context the flute is rarely used solely as tutti or solo instrument. Most orchestral works employ the instrument in both capacities. This will have a direct influence on the freedom of vibrato application. Galway encourages flautists to apply the rules more “elastically” when the flute is treated as a solo instrument, and writes, “when a couple of instruments ... are doing the same thing ... the freedom is only marginally less than when the flute is highlighted on its own, the musical opportunities and responsibilities [are] just as great” (1982:203).

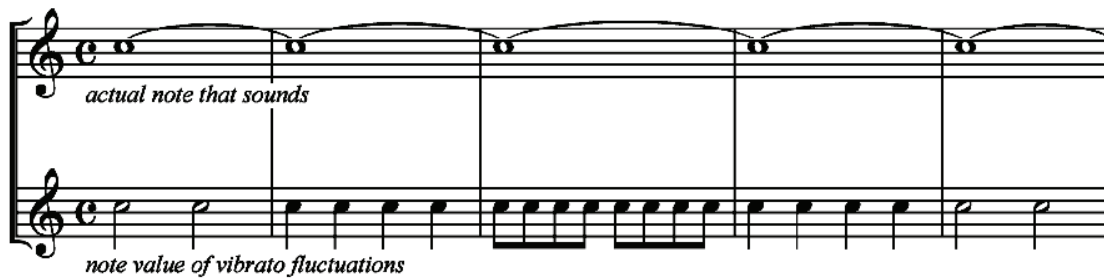
CHAPTER 5

Questions pertaining to the teaching of vibrato

5.1 Introduction

With the present vibrato sound ideal becoming accepted universally, one would assume that there would no longer be differences in opinion amongst musicians, or at least amongst flautists. However, another complication causes controversy and confusion amongst flautists, namely, whether vibrato can be taught or whether this should be a natural occurrence. This resulted in the development of two distinct camps with regard to teaching vibrato. In the one camp were Marcel Moyse and his followers. As already stated, he became a central figure in flute playing on account of his very expressive vibrato amongst other things, although he notably always denied playing with vibrato. Moyse believed that vibrato (referring to it as “expression”) should not be taught. This school of thought believed that adding this element consciously would result in something superficial, a mere imitation of real expression. Moyse believed something in the tone which gives a natural expression would emerge and that attempting to consciously apply a certain vibrato – particularly using the larynx – “was considered an utter sacrilege in his classes” (cited in Lehmann-Waffenschmidt 2005).

Moyse’s firm opinions on this point resulted in the rise of an opposing school of thought that believed and consequently proved that vibrato can indeed be taught. Prof. Cate Hummel, a present-day representative of the second school of thought, explains in an article entitled “Developing flute vibrato” (2002:18, 19), that vibrato can be taught. This is done by means of the commonly accepted practice of firstly playing eight quavers in a bar (tongued) and then playing a semibreve whilst creating pulsations with the abdominal muscles resulting in eight “beats” of the pulsating air column (as illustrated in the figure below). This can be continued until up to sixteen semiquavers can be achieved in a bar. Many modern flautists have adopted this practicing technique, including Geoffrey Gilbert, Trevor Wye, James Galway, and others.



Despite these differences in opinion, and despite Moyse’s reputation and influence as a teacher, his views tend to cause great uncertainty amongst many flautists. Moyse was not the only representative of this school of thought. For example, statements made by a great flautist like Rampal are even more rigid, and serve to emphasise the uncertainty about which school of thought is seen to be correct. According to Rampal (cited by Goll-Wilson 1986:11), “With much practice, within six months to a year the basic beautiful tone will develop. If not, perhaps a different instrument should be considered.”

With this in mind, one might well ask whether it is not possible to adopt an approach that combines these two seemingly opposing views. Nancy Toff believes that this middle ground can be achieved: “[A] third school takes a safe middle position: some players have natural vibrato, but others must be taught, and even those with natural vibrato can be taught to improve and control it” (1996:107).

This highly debated subject still lacks proper scientific research, something succinctly expressed by Papich et al.

Many teachers ignore vibrato as the best possible technique [of expression] in the belief that if one does not teach vibrato, something natural and good will develop. The fact that a student teaches himself vibrato ensures neither goodness nor naturalness. Analysis of performance practices of successful musicians, based on controlled scientific inquiry and not emotional speculation, may offer insight into this pedagogical problem and hopefully lead to a standardized technique to solve the problem (1974:33).

In the absence of such research, a combination of the two schools of thought would be the recommended route in approaching the teaching of vibrato.

5.2 Teaching vibrato

One of the first things that should be emphasised when teaching a student vibrato is that it should only be added once an already beautiful tone has been achieved. According to Toff (1996:114), “Vibrato can be a potent vehicle for musical expression. It is important to remember that vibrato is not a substitute for a full, beautiful tone. The flautist must be able to play a dolce, cantabile adagio totally without benefit of vibrato.”

William Kincaid⁴⁷ (cited in Toff 1996:114) attempted to explain this problem by using an Alice in Wonderland metaphor: “To Alice in Wonderland there was a Cheshire cat which grinned. Suddenly the cat disappeared and only the grin was left. Equation – grin, no cat = vibrato, no tone.”

Toff points out that, “In other words, vibrato is an ornament; while [vibrato is] present, [it is] an integral part of the tone, but the tone must be capable of standing on its own without any vibrato enhancement. Vibrato is not a means of disguising faulty intonation or a thin or distorted tone” (1996:114).

In an article in *The Musical Quarterly* entitled “Expression unconfined”, George Barrère uses the analogy of “make-up” to express his concern about the use of vibrato: “A plain face can be saved by the use of artificial means bought at a drug-store, but there is no make-up on the market that will make a real, natural beauty out of a homely face” (1944:193).

⁴⁷ William Kincaid, a famous American flautist, is described by Toff (1996:114) as “a master of [a] selectively expressive vibrato.”

This may seem like a rather harsh comparison, but the importance of creating a basic understanding of the “heart” of the tone is often neglected when teaching a student vibrato.

When teaching a student good tone, the student must be able to create a tone that they love and believe to be representative of their personality, before trying to introduce vibrato. This will help to avoid using vibrato for the wrong reasons, such as hiding a bland tone, alternating flat or sharp notes and imitating the teacher without an understanding of good vibrato. A student should therefore first realise that there are three basic elements to tone – supporting the tone, its shape and its resonance.

5.2.1 The heart of the tone: Support

The term support refers to the abdominal muscles controlling the speed of air with which a flautist plays.⁴⁸ Support is the starting point for a good tone and it involves more than just the diaphragm muscle. Good posture plays the most important part and it involves all the muscles in the body.

David Vornholt (no date) explains the techniques he uses when a student is incapable of producing any vibrato through imitation or tone exercises as follows:

I ask the student to cough very lightly, trying to feel the glottis opening and closing. This generally takes but a few minutes to accomplish. I then place the student’s thumb, first and second fingers over the muscles in my neck that control the glottis. Using my instrument, I play G2 and produce a very wide, slow vibrato. This allows the student to get a feel for how the effect is produced.

This will of course enable the student to understand the role of the glottis and throat in the production of vibrato. It is, however, essential that vibrato is produced through the interaction of the glottis and throat, and that it is the combination of both the throat and diaphragm that creates the perfect balanced fluctuation in sound, and therefore the most natural sounding vibrato.

⁴⁸ Refer to Chapter 2.3 for the muscular structures involved.

Vornholt (no date) further recommends the following technique to let the student understand the support that is expected of the diaphragm:

I next ask the pupil to play a G2 and using my hand doubled into a fist; I gently push and release the diaphragm, thus causing a slight fluctuation of the tone. I ask for a straight tone immediately followed by this fluctuation or push the diaphragm without any help from me by the use of my hand. Once this has been accomplished, I ask that the speed be increased; to increase the speed, the feeling will be more in the throat than from the diaphragm.

The best way to ensure that the proper support is applied is by exercising these specific muscles. The most extensive collection of exercises relating to breathing and support can be found in Toff's *The Flute Book*. These exercises are compiled by Toff and consist of her own exercises as well as recommended exercises of William Kincaid and Sarah Baird Fouse.

5.2.2 Exercises to correct faulty breathing and support techniques

In order to ensure that a flautist breathes correctly and supports their tone sufficiently, numerous exercises have been formulated over the past few decades to practice not only the breathing technique, but also to test whether every aspect of the flautist's body (thorax and abdomen) is co-operating fully in the production of sound.

According to Toff (1996:83), as a precursor to good breath control, aerobic exercise of any sort – jogging, swimming, callisthenics, basketball, etc. – will enable you to be a better flautist. Swimming has always been seen as the best form of exercise for a flautist due to the rhythmical element of the exercise, as well as the synchronisation of the breathing whilst being physically exerted.⁴⁹

⁴⁹ Interestingly, William Kincaid, who grew up in Hawaii, was a swimming protégé of Olympic champion Duke Kahanamoku (Toff 1996:84).

Isometric exercises refer to the flexing and relaxing of all the abdominal muscles involved in exhaling and supporting the sound on the flute. These exercises can be done while doing something else, such as waiting in a queue or doing paperwork.

Perhaps the simplest of all the exercises is straight breathing. It is important to stand up straight, with your feet apart and your hands on your hips with your fingers spread. It is important to always inhale and exhale through your mouth and gradually increase and then decrease the frequency of breathing. The importance of your fingers that are spread is to feel the expansion of not only your abdomen, but also your back, keeping a constant check on your abdominal technique.

Toff refers to another exercise noted by teacher Sarah Baird Fouse, called “the thinker”, in which you should sit in an armless chair with your elbows on your knees, your jaw supported by upwardly cupped hands. The aim of this exercise is to understand exactly how big the role of abdominal expansion is during breathing. In this position, it is impossible for the chest to expand and therefore the constitution of abdominal expansion at waist level should be palpable and clearly visible (Toff 1996:84).

Another simpler exercise, referred to as “the balloon” (or “the accordion”) is done while standing and placing the palm of one hand about 2.5 cm in front of the lower abdomen. The aim is to inhale slowly (to the count of 5 seconds) until the abdomen touches the palm of the outstretched hand and then exhale slowly for five more counts until all the air is expended.

William Kincaid (cited in Toff 1996:84) prescribed two variations of traditional calisthenics, which he labelled “push-ups and pullbacks”. The push-ups resembled a normal push-up, but with the essential difference that controlled breathing should now be added to the exercise. The aim is to inhale deeply before pushing up and arching your back, followed by controlled exhalation as you return to the relaxed position on the floor. Furthermore, you should increase the number of push-ups done per breath. In the second

cycle, inhale, do two push-ups and then exhale. The aim is to finally be able to do about six push-ups per breath cycle.

The pullbacks are sometimes seen as vertical push-ups. You should stand up straight with your arms stretched up over your head and then rapidly move your arms to your sides while bending your elbows and trying to have them touch behind your back.

Toff also refers to an exercise she has developed, called “the hiss”. The idea of this exercise is to place your thumbs and fingers around your waist, inhale correctly, and with the appropriate flute embouchure, exhale whilst making a snake-like hiss. The reasoning behind the hissing is because this will, in combination with your abdominal muscles, restrain the airflow and help in developing the support muscles.

Kincaid also refers to a “candle exercise” similar to one advocated by Taffanel (cited in Toff 1996:84) in which the aim is to control the shape of ones embouchure. A candle should be held in front of you (about 30 cm), at shoulder height, using both hands to keep it steady. The aim of this exercise is to exhale with the correct embouchure and try to make the flame flicker without being extinguished. This exercise will help to play long, sustained phrases and help to develop better breath support.

Lastly, Toff (1996:85) suggests an exercise that is useful in both the development of tone and the sustaining of longer notes:

Take any middle register note between c2 and a2. Play it as long as possible and time yourself. (The easiest way is to set the metronome at sixty beats per second and count the clicks.) Do this each day, on a variety of notes, and keep a written record of your progress.

5.2.3 The heart of the tone : Shape and resonance

The shape (e.g. large, small, airy, etc.) of the sound, on the other hand, is controlled largely, although not solely, by the embouchure. Once the support and shape of the tone are in place, one can start focusing on cultivating a beautiful tone.

When referring to resonance, it is important to stress the fact that every note on the flute has a different “sound”. Ann Cherry (cited by Krantz 2005), for example, explains to her students that, because every note on the flute is literally a different length of vibrating air column, it is only natural for the actual sound to differ as well. Although these notes do differ, it is not the actual length of air that results in varying timbres, but the combination of overtones when producing certain notes. The difference between every single note is not as clearly noticeable, but there is a definite difference in the three registers. There are also certain notes that have varying timbres due to the fingering required to produce these notes. Although we are trying to get a sonorous sound throughout the flute’s registers, the trick is to use this small variation in sound musically so it becomes not a quirk of the instrument but a musical device. For example, it is common knowledge that the c-sharp in the first octave has a more “hollow” sound when compared to the c or d circumjacent to this note. Flautists usually employ more vibrato on this note to hide it, but this unique timbre can be utilised in certain situations by minimising the vibrato on the note, which could create a timbre suited to a specific mood.

Only when this is mastered can the student be taught to experiment with vibrato. It is important for the student to realise that vibrato should always be a natural extension of himself or herself, and not something merely imitated, copied or forced. Furthermore, although the student is here advised to experiment with vibrato, it should always be done under close supervision of the teacher. Once a certain type of vibrato has been established, it is often very difficult to alter.

5.3 Problematic vibratos

Looking at all the different types of vibrato that are perceived as disturbing to the ear, David Jones (2007) writes that these can be classified into the following three groups:

5.3.1 The wobble

A vibrato that is not regular in pulsation, frequency and amplitude is often disturbing to the ear. Jones mentions that more often than not one hears singers that have a wide and slow vibrato. This he ascribes to a lack of proper resistance of the breath pressure or lack of focus in tone.

In the case of flautists, it is most likely to be misuse of supporting muscle structures or even muscular stress that is transferred onto the glottis, resulting in an uneven vibrating of the throat structures.⁵⁰ It is nearly impossible for a student to obtain a controlled, regular vibrato without good support. If the student tries producing vibrato without proper support, there is a risk that he or she will develop unnecessary stress in other parts of the body in an attempt to compensate for the lack of diaphragmatic support. It is imperative to break this pattern of playing as soon as it becomes noticeable. Firstly because it could cause muscular damage or medical conditions such as tendonitis and secondly because of the difficulties of changing techniques that have been established in the beginning stages.

The only solution for this problem would be the daily vibrato exercises introduced by Hummel (2002:18), referred to earlier in this chapter. It is important for the student to focus on a natural and regular sounding vibrato, and it must be emphasised that a problem like this cannot be fixed quickly. It could take weeks, even months, to change a student's vibrato and have them be comfortable with their new sound. The key in these exercises is not only control, but also the use of the correct amount of support from both the embouchure and the diaphragm.

⁵⁰ Jones (2007) notes that the vocal wobble found in singers is a result of age or an unhealthy vocal and vibrato technique.

5.3.2 The slow, heavy vibrato and the nanny goat quiver

The three registers of the flute require different amounts of physical effort to obtain similar sounding vibratos. What sounds beautiful for an upper register vibrato may sound awful in the lower register. On the one hand, difficulty in adapting to different registers can result in a too slow and heavy vibrato. This is the so-called “lazy” vibrato, consisting of a too slow and heavy vibrato. Jones (2007) compares this to “a tired cellist wobbling on long notes”.

On the other hand, failure to adapt to different registers sometimes results in a vibrato that is too shallow and fast, sometimes referred to as the “nanny goat quiver”. This type of vibrato is often found when young students naïvely attempt to produce a vibrato by imitation only, without being shown how to utilise the diaphragm as well. Although many South American ethnic flautists and pop-vocal styles make use of this “quivering” vibrato, it is not common practice to use this type of vibrato in western classical music.

The biggest problem with this type of vibrato is that it is a hard habit to break, especially in cases when a *senza vibrato* sound would be appropriate. When looking at the physiological production of vibrato, it is usually the throat muscles that are mostly used to produce this type of vibrato. This makes it even more difficult to vary the tempo, i.e. frequency of the vibrato, due to the limited control that a flautist has when using solely throat vibrato.

The most significant problem with these vibratos is not just the rate of fluctuation, but that it is too monotonous, spread equally throughout all the registers of the instrument. This is most probably the least desirable quality to find when analysing a flautist’s sound. There should be enough variation in vibrato to avoid monotony, but whichever tempo and style of vibrato we choose, the vibrato should still be stylistically correct and within the boundaries of good taste.

The best way to correct these errors would be to get back to basics and to “re-introduce” vibrato (specifically focussing on the role that the diaphragm plays) with the aid of the Hummel exercises (2002:18), suggested earlier. Singers call these exercises vocalisation exercises, but flautists can use them to control not only the frequency, but also the amplitude of the vibrato. Furthermore, these exercises make it possible to experiment with the different types of vibrato so that the one we choose is in fact one of choice and not the only one we are capable of producing.

5.3.3 The straight tone

In almost every flute tutor, it is stressed that a student must be able to play with a clear, “silvery” tone and with a great dynamic range, from *pianissimo* to *fortissimo*, before he or she is introduced to the “secrets” of vibrato. In singing tutors, however, singing with a totally straight tone is sometimes seen as potentially damaging and extremely unhealthy. Vocal nodules can result from such vocal production because of too much vocal pressure held at the glottis to prevent vibrato from occurring in the tone. One may well ask if it is not also unhealthy to cause unnecessary strain on the throat structures involved in the production of vibrato on the flute.

The great difference is that when playing the flute, the vocal chords are subjected to a significantly smaller amount of pressure. The same muscles are being used, but the actual sound that is produced takes place on the outside of the body. The only thing that is produced and/or controlled on the inside of the body is air and not tone. It is consequently easier (causing less muscular tension) to produce a tone without any vibrato on the flute.

The straight tone therefore has no problematic physiological effects on the flautist, but rather becomes a problem due to the differences of opinion on this type of sound in terms of musical taste. A flautist runs the risk of having their sound seem monotonous and uninteresting if played without any vibrato whatsoever.

5.4 To teach or not to teach

As far as learning to produce vibrato is concerned, it seems appropriate to begin by quoting the following statement by Hummel (2002:19):

Listen to lots of soloists – flautists, string players and singers. Pay careful attention to how much, where and when these artists use vibrato. There is no better teacher than your own thoughtful and analytical listening. If you can hear what someone is doing, chances are that you can teach yourself to imitate⁵¹ it.

Marcel Moyse, interestingly, employed the same method, although he believed that the production of vibrato should not be something technical that is practised and controlled. Despite his views, he never stated that this cannot be done, and he was in fact fully aware of it becoming standard practice. What he strove for, however, was for flautists to be musicians, not mere instrumentalists, and he therefore believed that musicality should govern one's choice of tone and vibrato. If one's choices in sound and tone become too planned, one would lose spontaneity, one of the magical elements of self-expression.

It is the present researcher's belief that it is indeed possible to reconcile the two schools of thought with regard to the teaching of vibrato, because it seems likely that vibrato could be practised and controlled without losing the spontaneity that musical expression requires. Hummel (2002:02) provides a fitting summary of notion: "It is counter productive to count the pulses of your vibrato when you are playing after you have learned to control the speed. Doing this is way too cold, analytical, and scientific. Using vibrato has to do with warmth, emotion, and life itself."

As with all techniques, it is extremely important to ensure that the correct muscles are being used when teaching a student vibrato. Once incorrect habits have settled, it is extremely difficult to remove these ideas from the muscular memory. The most important thing in teaching vibrato, however, is the importance of basic tone quality before

⁵¹ Imitation, however, should only be used to acquire a new type of vibrato, and should not be blindly applied by mere copying.

introducing vibrato to the young student. There is no easy road to its instruction, but once accomplished, the pupil will be well on the way to conquering some of the intricacies of the flute.

Lastly, it should be noted that the other school of thought with regards the teaching of vibrato, i.e. with Moyse as chief representative, undoubtedly also has merit. In this case, certain concerns should be taken into consideration, as Moyse (1962:89) points out:

Vibrato is not tone – it is an addition to tone. Doesn't it seem logical to teach correct tone quality and breath control first, and after these are acquired to let the rest come with maturity? If a student doesn't have the emotional equipment to really feel music – to sing it, as we say – do you really believe that in his robot-type of playing he should mechanically vibrate so many pulsations on each tone? I can't quite bring myself to believe that this would enhance his performance in any way.

It could therefore be said that the secret to teaching vibrato is in balance. The truth lies sometimes with the one and sometimes with the other view, depending upon the pupil. The real problem for the teacher is to know when to apply one or the other method, and to be sufficiently broad-minded to recognise the value of each method.

CONCLUSION

The discussion of vibrato is undoubtedly an ongoing process, not only amongst flautists, but also amongst all instrumentalists incorporating it in their playing. As shown in this thesis, the subjectivity of this phenomenon makes it difficult to reach consensus on its application. Yet, as has also been argued, this problem is not insurmountable. It has been a point of discussion for centuries and opinions have differed greatly over time. Vibrato is continuously evolving with the *Zeitgeist* and it is likely to keep on changing.

On the one hand, we have the guidance of great flautists and musicians to help us understand what type of vibrato is seen to be historically informed and appropriate. On the other hand, it is important not to be “boxed in” by these opinions. We must be able to be creative and individualistic in our performance, whilst still respecting the guidelines and boundaries of good taste.

The fact that flautists are given great freedom of choice in their use of vibrato does not imply that they should not work on it and in some cases change it. On the contrary, the choice of vibrato should be a conscious decision informed by knowledge about the physiology of the body, which allows the flautist to understand what parts of the body are involved in the process and to be able to control them, thus controlling the vibrato.

The only way that flautists can improve their sound and vibrato is by critically listening to themselves, constantly analysing the type of vibrato produced. They must know whether their vibrato tends to sharpen or flatten certain notes, as well as be sensitive to the width and speed of the vibrato used. It will only be possible for a flautist to blend with other musicians once he or she is conscious of his or her own vibrato. This may seem an arduous task, or an overly analytical approach to performance, but it is crucial to cultivate this consciousness of one’s own sound. It is only once this is achieved that a flautist will develop the ability to make the correct choices concerning the appropriate vibrato to apply in a given context.

It is only after a flautist has achieved complete control over his or her own vibrato that he or she can start adjusting to other instruments, be it in an ensemble or an orchestra. In my view, adaptability of vibrato has been grossly neglected in most essays on vibrato studied for the purpose of this dissertation.

Numerous factors should influence the choice of vibrato. On a larger scale, the style of the piece (e.g. Baroque era) should determine the choice, whilst on a smaller scale, it would be the specific mood (e.g. *Agitato*) of the piece being performed. Looking even closer, each phrase in itself will contain harmonic tension, resulting in the flautist utilising vibrato to stress important notes.

In an ensemble context, the same guidelines apply, but the variables of the instruments performing with a flautist also come into play. The flautist now has to adjust to other types of instruments and their specific application of vibrato. The importance of the material performed by the flute (e.g. solo or as accompaniment) has a direct influence on the amount of freedom of expression (and choice of vibrato) that the flautist will have. Flautists should therefore acknowledge these factors and adjust to them accordingly.

The purpose of this thesis is to aid flautists in equipping themselves with the necessary knowledge to be able to make informed decisions about the application of vibrato. Only when one has command of all the different types of vibrato, will one be able to choose the kind of vibrato appropriate to the circumstances.

Most importantly, it is not enough for flautists to become more knowledgeable about the issues raised in this thesis; they should also convey these principles to their students. If vibrato is not constantly discussed and approached in an open-minded fashion, flautists will stagnate and become frigid in their approach and application, resulting in the stifling of freedom of expression.

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List of figures

	Page
1 The principal throat structures	28
2 The larynx	29
3 The action of the cricothyroid muscles	31
4 The action of different muscles in the throat	32
5 The correct posture	38
6 The dissection of 2 ribs and the intercostal muscles	40
7 The levatores costarum muscles	41
8 The muscles of the neck involved in breathing	42
9 The external <i>obliques</i> (A), internal <i>obliques</i> (D), <i>transverses abdominis</i> (B) and <i>rectus abdominis</i> (C)	44
10 The diaphragm	45
11 Subglottic pressure	52
12 Pitch fluctuation of the note a1 (introductory notes)	61
13 Pitch fluctuation of the note b-flat1 (introductory notes)	62
14 Pitch fluctuation of the note b1 (introductory notes)	62
15 Pitch fluctuation of the note c2 (introductory notes)	63
16 Pitch fluctuation of the note c-sharp1 (introductory notes)	64
17 Pitch fluctuation of the note d2 (introductory notes)	65
18 Pitch fluctuation of the note b1 (mezzo forte)	66
19 Pitch fluctuation of the note b2 (mezzo forte)	66
20 Pitch fluctuation of the note b3 (mezzo forte)	67
21 Pitch fluctuation of the note g1 (mezzo forte)	68
22 Pitch fluctuation of the note g2 (mezzo forte)	68
23 Pitch fluctuation of the note g3 (mezzo forte)	69
24 Pitch fluctuation of the note b1 (forte)	70
25 Pitch fluctuation of the note b2 (forte)	71
26 Pitch fluctuation of the note g1 (forte)	71
27 Pitch fluctuation of the note g2 (forte)	72
28 Pitch fluctuation of the note g3 (forte)	73
29 Pitch fluctuation of the note b1 (piano)	75
30 Pitch fluctuation of the note b2 (piano)	75
31 Pitch fluctuation of the note g1 (piano)	76
32 Pitch fluctuation of the note g2 (piano)	77
33 Pitch fluctuation of the note g3 (piano)	78
34 Pitch fluctuation of the note b1 (projected)	78
35 Pitch fluctuation of the note b2 (projected)	79
36 Comparison of projected and forte b2	80
37 Pitch fluctuation of the note g1 (projected)	80
38 Pitch fluctuation of the note g2 (projected)	81
39 Pitch fluctuation of the note g3 (projected)	82
40 Comparison of normal b1 with that of a piano b1 without embouchure adjustment	83

41	Pitch fluctuation result when a forte b1 (without embouchure adjustment) is compared to a b1 that is played in tune	83
42	Pitch fluctuation of the note b1 (projected)	84
43	Pitch fluctuation of the note g3 (projected)	85
44	Comparison of pitch fluctuation	86
45	Comparison of minimum pitch fluctuation values	87
46	Comparison of maximum pitch fluctuation values	88